wholly upon air.

The seven phenomena connected with violin exits are:

(a) Position of exits may diminish or increase tone-power.

(b) Increasing area of exits augments volume and diminishes intensity of tone.

(c) Diminishing area of exits augments intensity and diminishes volume of tone.

(d) Diminishing area of exits lowers tone-pitch.

(e) Enlarging area of exits raises tone-pitch.

(f) Diminishing area of exits diminishes noisy tone-quality.

(g) Enlarging area of exits accentuates noisy tone-quality.

In view of this display of facts, there is little wonder that great interest attaches to violin exits. Because of not having a satisfactory explanation for the phenomenon in raising and lowering tone-pitch by enlarging or diminishing area of exits, therefore none is offered; but, in advance, I offer thanks to anyone for such satisfactory explanation.

(a) Position of exits may diminish or increase tone-power.

This fact is susceptible of conclusive demonstration. Thus: Placing the exits in the ribs of the middle bout, other conditions remaining as usual, operates to diminish tone-power. The reason for such diminution is apparent; the exits thus placed are not in the line of sound-wave concentration. This conclusion is proven by closing such exits, and placing others in the usual position. The striking increase in tone-power following such change in position is the measure of sound-wave concentration in that particular violin; but, is not a measure of such concentration for another violin having a greater or less height of plate-arching. Again, placing the exits nearer to the edges of the sounding-board operates to diminish tone-power, but, the degree of diminution varies with the height of arching; the lower the arch, the less diminution in tone-power. It is obvious that increasing height of arching operates to increase sound-wave concentration in the direction of the center join of the plates; therefore, the higher the arch, and the nearer the exits are placed to the center join, the greater is tone-power. In practice, I find a variation of $\frac{1}{8}$ in distance from center join to the exits operates to change tone-power when height of arch equals $\frac{5}{8}$ or more; below $\frac{5}{8}$, the change in tone-power is less marked. In this matter, the pattern for exits should vary in width of curve at the ends as the degree of tone-power desired. Thus, with diminished width of curve, the exit may be placed nearer the center-join; width of curve increased, places the exit at a greater distance from the center-join. For position of exits, hard-and-fast rules cannot apply.

(b) Increasing area of exits augments volume and diminishes intensity of tone. My explanation for this phenomenon begins upon a well made violin, of good model and good wood, and having no exits whatever, but having other conditions as usual.

In this condition, the plates remain motionless and toneless under vigorous bow pressure. Its admirable sounding-board cannot act. Contained air will not permit it to act. Elasticity in air molecules within this violin body is a resisting force vastly greater than force in the strings. Only by permitting escape of part of this resisting energy can this sounding-board be excited to action. For the purpose of observing the effect upon this sounding-board, I shall permit escape of such resisting energy in gradually increased degrees. If my reasoning is sound, then sounding-board activity will increase as escape of resisting force increases. With this object in view, I outline the exits in their usual position, and cut out the smaller round at their upper extremities. Application of the bow now produces sound, but it is a sound of small volume, of low pitch, and of marked intensity as compared with volume. It is clear at once that small volume of this sound is due to escape of but a small amount of molecular, elastic energy, but reason for the intensity of this tone is not so clear, while reason for its low pitch drives me into the region of mere supposition. I know the supposition of philosophers upon this point, but supposition lacks much of being satisfaction. That the varying lengths of air columns confined yield sound of equally varying degrees of pitch is amply demonstrated in organ pipes, horns, steam whistles, and all wind instruments; but, after enlarging these exits to one half usual area, how may we account for the greatly raised tone-pitch following? It is clear that the greater volume of sound following such enlargement is due to greater escape of molecular, elastic energy; also, that such increased escape of energy, by diminishing resistance, permits wider amplitude of sounding-board activity; hence greater force in the blow delivered upon contained air; hence greater volume of tone.

After enlarging these exits to their usual area, application of the bow determines another great addition to volume of tone. Again, after enlarging these exits beyond their usual area, volume of tone is yet increased, tone-pitch is raised, but, intensity of tone is diminished, and noisy tone-quality is accentuated.

How far such increase in area of exits may be extended without complete ruin to tone-value is one of the demonstrations I have not made. It is evident that such increase has its practical limits. We know that total absence of confining walls permits dispersion of sound-waves equally in all directions; that such dispersion operates to diminish intensity of sound to the minimum. It is apparent that area of the exits may be so great as to permit an amount of dispersion greatly dimiminishing intensity of tone. It is a well known fact in physics that the greatest volume of sound occurs in open air where no confining walls are present. In view of these facts, it is evident that diminishing the area of exits operates to diminish volume of tone, to increase intensity of tone, and to diminish noise.

In the work of artistic violin construction, I know of no factor possessing greater importance than area and position of the exits. Considering good material and good model to be present, then area and position of the exits must be relied upon to satisfy the varying tastes of violin users. Thus, that builder who only desires to please the taste for great volume of tone, will place exits of large area as near to the center join as is practical; and, that builder who only desires to please the taste for diminished volume of tone, increased intensity of tone, and diminished noisy tone-quality, will place exits of small area at a greater distance from the center join. From my view-point, it seems but wisdom to be prepared for all varieties of tone-taste; therefore in the work of tone-regulation upon violins intended for such as prefer quality before volume of tone, it is necessary to cut the exits too small at first, and to increase their area only after application of the bow. In my experience, it is a fact standing out in strong relief that hard-and-fast rules for the area of exits cannot apply. Thus: If a sweet, intense tone is desired, then the exit of large area operates to defeat intention. Again, differing degrees of arching operate to cause differing lines of sound-wave travel; therefore, position of exits must approach to, or recede from the center join as the variations in height of arching; therefore, hard-and-fast rules for position of exits cannot apply.

In this matter, as previously stated, the violin builder must rely wholly upon experience and observation. There is no alternative. In this matter, that colossal thing called "science," is as help-less as an infant. In the case of the barrel-shape violin, we may rest assured that the exits are not in the line of sound-wave concentration. Such assurance is based upon the fact of feeble tone-power invariably existing in violins of such model. The tone-power from this rotund violin is but the tone-power of an infant; whereas, the tone-power from this flat-model violin, its every line a line of beauty, merely suggesting rotundity, sets every beam of the house into a rollicking two-step. Without a shadow of doubt, the exits of the latter violin are in the line of sound-wave concentration. I believe that continued trial might determine the precise distance of the exits from the center-join for each degree of arching. With the intention of producing maximum tone-power, such figures would possess value.

Oft repeated demonstrations have firmly established the fact that increasing the area of exits operates to raise tone-pitch. I confess this phenomenon seems paradoxical. I cannot divest myself of an impulse to think that the contrary result to tone-pitch should follow enlarging the exits.

[Here is a demonstration for the fact that preconceived ideas may lead one into error. Often upon arising in the morning at some strange place for which we had formed preconceived ideas of the different points of the compass, the sun seems not to rise in the east. It may appear to rise in the north, and even in the west; and, it may obstinately refuse to rise in the east so long as we remain at that point. Thus am I affected by the phenomenon of raising tone-pitch by enlarging area of exits. Again I offer thanks in advance for a satisfactory explanation for thus raising violin tone-pitch.]

The small amount of such enlargement necessary to increase volume of tone, and, raise tone-pitch is a matter for profound surprise. Removal of but a single shaving from the inner edge of an exit is sufficient to change these two qualities of tone.

The philosophy for diminishing or accenuating "noise" in violin tone by diminishing or increasing area of exit is not difficult of explanation. The cause for "noisy" violin tone, as previously shown, is due to small areas of greater thickness of wood located in sound-producing parts of the sounding-board; and, because of such limited tone-producing area, it is apparent that the tone therefrom possesses but feeble power. It is also apparent that any agent operating to diminish violin tone-power, might operate to annihiliate the feeble noise-wave. Hence, diminishing area of the exits augments sweetness of violin tone; also, when the cause for "noise" exists, increasing area of the exits operates to accenuate such noisy sound.

Feebleness of the noise-wave is easy of demonstration. Take the noisiest violin out in the open and apply thereto the utmost vigor of the bow, while the listener retires to a distance. As distance increases, noise diminishes, while musical sound yet remains distinct. Position of exits exerts considerable influence in producing that rumbling character in violin-tone so aptly described as "tone-all-inside." Although faulty interior lines of the plates are the chief factors in producing this character of tone, yet, position of the exits may add to or subtract from such rumbling sound; but, in cases where such rumbling sound is marked, the position of exits cannot be relied upon to effect complete cure. Indeed, there seems to be no cure for serious cases other than building new plates having correct interior lines; that is, lines which continually, and with precise regularity, direct sound-wave movement in the direction of the exits instead of directing such movement away from the exits. To produce the maximum tone-power, when interior lines operate to direct sound-wave movement from the exits, is an utter impossibility; also, with such lines absolutely perfect, placing the exits away from lines of sound-wave travel defeats maximum tone-power. In the production of maximum tone-power, interior lines of the plates become prodigious factors; whereas, exterior lines exert no influence whatever. Therefore, in producing maximum tone-power, it becomes necessary first to establish interior lines of the plates, and thereafter reduce thicknesses by work on exterior lines. Thus, the highest point in the longitudinal arch, viewed from the interior, may be placed at the position of the bridge; thus, sound-wave movement cannot be directed away from the exits when exits are placed at the nearest practical distance to the center-join.

(12) Depth of ribs is the last factor in the list of

tone-modifiers for consideration. The chief effect upon violin tone from depth of ribs is manifested upon tone pitch; yet, the effect of this factor upon volume, intensity, and brilliance of tone is worthy of consideration. Other dimensions remaining equal, diminishing depth of ribs operates to deminish volume of tone, while intensity and brilliance of tone are increased. In experiment upon this factor I have diminished depth of ribs from 1 and $\frac{1}{4}$ inches, down, by degrees of 1-16, to a depth equalling $\frac{3}{4}$ inch; and from this depth, have rebuilt such ribs, by additions of $\frac{1}{8}$, to the depth of 1 and $\frac{1}{2}$ inches. Such changes in depth, being given to one particular violin, afford conclusive proof that shortening length of perpendicular air columns within the violin body operates to raise tone-pitch, and vice versa, to lower tone-pitch. In diminishing depth of ribs to $\frac{3}{4}$ inch, violin tone undergoes remarkable changes in character; volume of tone is greatly diminished; tone-pitch is greatly raised; and intensity and brilliance of tone are greatly increased. Next to the area and position of exits, depth of ribs is the most potent tone-modifier in the list. At the extreme depth of 1 and $\frac{1}{2}$ inches, volume of tone is greatly increased, while intensity and brilliance of tone are greatly diminished, and tone-pitch is greatly lowered. In my observation, variation of 1-32 inch in depth of ribs perceptibly operates to change [redacted] these tone qualities.

In cases of hollow, weak tone, caused by too great diminution of sounding-board thickness, I have added greatly to tone-value by simply diminishing depth of ribs; and, the amount of such diminution is always governed by the degree of tone-weakness in each case. Such diminution may equal 1-32 or 1-16, or $\frac{1}{8}$ inch when arching equal $\frac{5}{8}$, and depth of ribs equals 1 and $\frac{1}{4}$ inches. In this work, the point is to diminish volume of tone, and to increase intensity of tone, brilliance of tone, and to raise tone-pitch. Such effects upon tone follow with certainty, even while all other dimensions remain equal. It is my observation that "noise" disappears from violin tone as weakness of tone increases; and no matter whether weakness is caused by too great thickness or too great diminution of sounding-board wood, or by diminished area of the exits, or by application of a mute to the bridge. Thus the hollow, weak tone is never a noisy tone.

[There are situations where volume of tone may be of greater value than intensity of tone. Such situations are found where music is drowned by noise from shuffling feet, from loud conversation, from clinking glasses, from popping corks, and from clinking sound of silver coin; situations where music is wasted on desert air—I mean "smoky air"—situations wherein the only hope of æstheticism is centered in the snowy crown of carbonic oxide overtopping the graceful schooner. In such situation you are advised to increase the area of the exits.]

Extraneous factors operating to diminish violin tone-power are:

(1) The mute.

(2) Bow-hair.

Philosophy involved in the mute is the only feature of interest that the mute possesses for the student of violin tone-peculiarities. The mute clearly demonstrates the amazing value of the bridge to violin tone; and such demonstration places in a clear light the fact that the bridge, in transmitting force to sounding-board, operates by vibratory action. Because the mute diminishes such vibratory action, therefore, the mute is of value in demonstrating the fact that rigidity of bridge-wood fiber may be so great as to diminish tone-power. The mute is also of value in demonstrating the fact that the noise-wave disappears first in diminished tone-power. Thus, no matter what the degree of accent given to noise by any violin, application of a mute to the bridge operates to annihilate such noise. Therefore, when a case of "nerves" exist in the neighborhood of a noisy violin, the mute is raised to the degree of benefactor. Vivid recollections suggest that two benefactors might be better than one.

(2) Bow-hair, and the stick itself, may operate to diminish both volume and intensity of tone. I recollect an astonishing occurrence connected with worn out bow-hair. A certain player gave himself the trouble of taking a day's journey to consult me about an unaccountabe loss in the tone-power of his violin. As he presented his violin and bow to me, he remarked, "It used to have a good, strong tone." Upon attempting to draw tone from his violin, I at first thought his bow-hair had been smeared with grease, for it slipped across the

strings without producing as much tone as follows the employment of the mute. Nor did increased pressure help the matter. Examination of the hair disclosed two conditions operating to diminish tone-power. First: Diameter of the hair was of the smallest variety. Second: The barbs or scales upon which dependence is placed for exciting string-action, were worn entirely away. Laying aside his worthless bow, I applied one of mine. His violin did possess a good, strong tone. Questioning brought out the fact that he had given much employment to steel E's. How any one, having sufficient intelligence to read music, could fail to know the cause for loss of tone-power in this case is a problem in human peculiarities for which I offer no explanation.

Without doubt, had this party paid a good price to a good violin maker for a good violin, he would now be condemning such maker as a fraud. Under such provocation, the "old masters" might be excused for restlessness.

To-day it seems scarcely necessary to state that bow-hair should be coarse and strong; that the best hair is obtained from the male equine; that, because the barbs thereon point in one direction, therefore, to secure equal force to up and down strokes, one-half of such barbs should point upward and one-half downward; that, when those barbs become worn by friction upon the strings, and worn by friction upon lumps of "rosin," then the "hank" should be turned over; that, when again worn, the whole "hank" should be thrown away.

There is truth in saying, " 'Tis more difficult to find a good bow than to find a good violin." In approaching dotage, I repeat that saying. But two times in fifty years use of the violin do I recollect of holding in hand what I call a good bow. During those years, I have held in hand many good violins. What I call a good bow is one that balances at a point seven inches from the frog; that springs back into the position of rest with the celerity of tempered steel; that has the lowest point of the "cambre" in its upper third, and well up toward the tip; one that seems instinctively to hug the strings.

At the next hour, the subject of maximum evenness of tone-power will be presented.

LECTURE XIV.

GENTLEMEN: I am now to present maximum evenness of violin tone. I confess to no little dread in approaching this problem. Perhaps dread causes me to defer its presentation until near the close of our course. Perhaps the fact that my solution for this problem has received but a single demonstration operates to increase my dread. I know full well that one swallow does not make summer. I also know full well that the most misleading writers upon the violin are such as write up tone-peculiarities of but a single violin. To present the tone-peculiarities of a single violin as facts existing in all violins ought to make the writer liable to criminal prosecution upon the charge of conspiring to defraud.

Only such factors as depend upon the action of air may be relied upon as constant factors influencing violin tone; whereas all such factors as depend upon the action of wood are not reliable, not constant, but, on the contrary, are capricious in action from first to last. 'Tis such capricious action that prevents application of hard-and-fast rules to violin construction. 'Tis plainly evident that the market would be glutted with "best" violins could hard-and-fast rules apply to violin construction. 'Tis capricious action of wood which makes the violin stand in a class by itself. 'Tis quite within possibility to tone-regulate all other musical devices in such uniformity as makes the tone of one precisely like the tone of another; whereas, no degree of human skill can make two violins sound precisely alike except at rare intervals.

Hence, whoever writes up the details of a single good violin as being details infallible in tone-results is chargeable with fraud, whether intentional or not. Again I state that only such violin tone-modifiers as depend upon the action of air can be relied upon as infallible factors.

Bearing this fact in mind myself, I ask that you also bear the same fact in mind when either studying or applying my details for maximum evenness of violin tone. That these details may fail at times and succeed at other times is as much of a certainty as the capricious action of wood. With no desire whatever to enlarge upon my own achievement, I state that these details for evenness of violin tone-power were traced on paper as a result of *a priori* reasoning. This fact operates to humble my pride. The fact that I devoted a lifetime to the study of violin tone and only succeeded in securing but a single beneficial factor thereto by *a priori* reasoning is humiliating. Yet, from no authority whatever, can I find another factor beneficial to violin tone which was traced on paper prior to the fact. All along the violin's 400-year path no fact is so prominent as the fact that every factor beneficial to violin tone is due directly to experiment alone. Hitherto, the tracing on paper of every such factor has been a result of *post facto* reasoning. Practically, to the violin there is no difference in favor of either method for tracing beneficial factors. The only benefit lies with the violin student; and, such benefit consists wholly in encouragement. If thought can secure one factor of benefit to violin tone, then thought may secure two such factors. There's the point! To say, "The violin reached perfection 200 years ago," is profoundly discouraging to all who accept it as the truth. Happily it is now generally understood that this saying, in late years, originated with the old-violin-trade-promoter.

Application of details for maximum evenness of tone-power was accomplished upon only a single violin; since when, this three-wheel-chair, whence I address you, has occupied my attention. So marked was evenness of tone-power in this single demonstration that I feel encouraged to ask that you take my solution where I leave it; and, should my solution prove correct, then will I be amply rewarded.

Without diagrams, I am confronted with an unusual degree of difficulty in the selection of words to describe accurately the details for maximum evenness of tone-power; therefore, you may find concentrated thought necessary to an understanding of their description. In such case, I know of no other way than repeatedly going over the ground. Such repetition is work, but, for such work I offer you encouragement.

As a means for assistance in making the details for evenness of tone-power stand out in a clear light, it is first necessary to present the lines of reasoning which led up to the fact. Only by slow steps and concentrated thought could I follow those lines to a conclusion; and even thus proceeding, I found necessity for bridging one yawning chasm with a mere "guess." As you may have observed in emergencies, "guessing" quite often becomes a necessity.

Every musical device possesses a fundemental, or lowest tone peculiar to itself; and, in all musical devices, except the strings, provision is made for the production of tones, higher in pitch than the fundemental tone. In all wind instruments, such provision is based wholly upon the action of air; whereas, with the strings, such provision is based partly upon the action of the air, and partly upon the action of wood and strings. This difference places the string family in a class by itself; also, this difference immensely complicates the problems involved in production of string-tones; also, this difference defies human skill to produce precise uniformity in string-tone values.

Although the piano is a stringed musical device, yet; because every one of its tones is a fundamental tone, while the violin has but four fundamental tones, therefore there exists but a remote relationship between these two devices. Because piano tone depends upon the direct blow of a hammer, therefore, the piano belongs in the class of percussion devices, notwithstanding employment of a sounding-board to augment tone-power. The tone of the violin depends upon the winding and unwinding of strings, and employment of a sounding-board for augmentation of power. Hereat terminates similarity in these two devices. The sounding-board of the piano must be lengthened, shortened, widened and regulated in thickness to accommodate each and all of its fundamental tones, whereas, that particular part of the violin sounding-board, augmenting the fundamental tone of each string, must also augment all other possible tones upon each string. This dissimilarity operates to permit evenness of tone-power in the piano and to cause unevenness of tone-power in the violin.

Concentrated thought and experiment, directed to the piano scale, (comparative length of strings and sounding-board) has resulted in a quite satisfying evenness of tone-power. In this quality of tone, the violin sounding-board yet remains faulty. Naturally, the question arises, "Can concentrated thought and experiment improve the violin sounding-board in the matter of greater evenness of tone-power?"

In solving this question, it is first necessary to definitely point out errors in dimensions of the violin sounding-board. Naturally, those who believe that the violin reached perfection 200 years ago will decline to admit that imperfections exist in the 200-year sounding-board; or, that imperfections exist today in sounding-boards precisely similar to the 200-year sounding-board.

Possibly, no evidence whatever can change such belief.

As a successful method for maintaining error, there's none quite so successful as refusal of evidence. In calling upon the piano sounding-board for evidence of error in the violin sounding-board, there's bound to be some who will decline to receive such evidence for fear of being convinced against their will.

Here follows such evidence:

(1) The piano sounding-board is heaviest beneath the larger strings.

(2) The piano sounding-board is lightest beneath the smaller strings.

(3) The piano sounding-board is longest beneath the larger strings.

(4) The piano sounding-board is shortest beneath the smaller strings.

In the Strad sounding-board there's no difference in length of sounding-board activity beneath the strings. In the Strad sounding-board there's no difference in thickness beneath the strings. From these facts, it is clearly evident that the violin sounding-board of 200 years ago had not reached perfection. [In the matter of producing evenness tone-power, some of the Joseph Guarnerius sounding-boards reached much nearer perfection than any sounding-board of the Stradivari.]

Because the piano sounding-board of today produces the greater evenness of tone-power, it is evident that error lies in the violin sounding-board; and, such error becomes apparent in attempting to produce two octaves of tone, having even power, upon any of the four violin strings. Even with the aid of increased bow-pressure, such attempt is a failure. The reason for such failure is apparent; the same length and thickness of sounding-board, engaged in augmenting the fundamental tone, must also be employed to augment the tone from the shortened, and consequently weakened string. For this fact, there is but one conclusion; that is both length of sounding-board activity, and rigidity of sounding-board are too great for the weakened blow from shortened string. Starting with the fundamental tone of any violin string, and counting half-intervals, there are twenty-five tones within two octaves to be augmented by an identical set of sounding-board fibers. Upon the piano, each of these successive tones is augmented by a sounding-board of diminished length, and diminished thickness. Upon the violin, such diminished length and diminished rigidity of the sounding-board, for each successive tone, is manifestly impossible. Indeed, equal evenness of violin tone-power with the evenness of piano tone-power would be a forlorn hope were it not for the aid from increased bow-pressure.

It is apparent that production of even tone power throughout two octaves upon each violin string is a problem beset with difficulties. It is also apparent that a solution for such problem is of value to violin tone; and in all conscience, to claim improvement upon the best sounding-board methods of Stradivarius and Joseph Guarnerius is apparently sufficient cause for hesitation. During 200 years, those methods have been faithfully copied by the most ambitious violin builders throughout the civilized world; and, in all the world, I've known of none, nor heard of none claiming improvement upon the best from those two famous experimentalists. Yet, notwithstanding the fact that none are found making such claim, I know of modern violins equally as beautiful in tone as any Strad I've ever heard, and, while equally sweet in tone. possess greater evenness of tone-power.

Why not claim the due?

I cannot see any harm in claiming such due when the claimant has the goods to show!

'Tis true, 'tis best to never claim more than is due; and, 'tis best to be modest in making any claim for onesself; but, 'tis of no avail to hide one's light under a bushel. The world is ever ready to accord merit at the moment of conviction that merit is due; but, the world rightfully demands proof before judgment.

By all considerations, submit the proof.

In submitting such proof, there's none to fear except the old-violin-trade-promoter; and, it is now quite generally understood that he is booked for that port where willful liars are consigned.

As we elderly students of the violin vividly remember, Ole Bull could draw four octaves of quite even musical tone from each string of his "Joseph." As all students of the violin know, 'tis a fallacy to claim such merit to lie wholly with the performer. No matter who the performer, he first must hold the goods in hand. It is my own observation that the "Joseph," among old violins, remains unequaled as a solo violin in the larger auditoria; and, such opinion is based upon the fact that the "Joseph" possesses both greater power and evenness of tone-power. 'Tis but natural for the student to ask, "What causes greater power and greater evenness of tone-power in the "Joseph?"

During many years, I have tried to answer this question, but, for same reason left to conjecture, precise data for the "Joseph" are kept as a valuable personal asset. Human nature yet remains very human. Concerning data for the "Joseph," Honeyman states thus: "The "belly" is thickest at the edges, and thinnest throughout the central areas." From such indefinite description, but little can be learned. Even a writer, so thoroughly equipped by education, by thorough training in violin construction, and, by opportunity for observation as Ed. Herron Allen, refers his readers to the Strad data for thickness of the "Joseph" tables, although claiming to have had M. Sainton's Joseph from which to obtain data.

Strange!

Here's one yet more strange. I sent to Paris for M. Simoutre's book and charts because among those charts was one of the Joseph. I received that book with the Joseph chart cut out.

"Diable!"

From a friend, I obtained a copy of a chart of the "Joseph." The original of this chart was made in the studio of Vuillaume. From the chart I received, and from Honeyman's indefinite description of the Joseph, I gave much time to repeated experiment. Today I'm not mourning the loss of Simoutre's chart; and, because of the opinion that is impossible for any one to give more time to experiment upon the possible varieties of violin plate thickness than I have given. Charts for the Stradivari, of several different varieties in plate thickness, are quite easily obtained. I have not only given repeated trial to all Strad varieties in plate thickness, but have also given many trials to the obtainable data for the Joseph. Between these two great genii, I unhesitatingly place the credit for greater tone-power, and greater evenness of tone-power to Joseph Guarnerius. For the greater duration of tone, and for the greater sweetness of tone, I place the credit to Stradivarius.

The method of plate-thickness finally adopted by these two successful experimentalists is presented for the purpose of making my lines of reasoning, leading to a partly new method, stand out in a clear light.

Thus: In experiments upon the Joseph method, it was clearly demonstrated that greater tone-power followed placing the thinnest point in the sounding-board half-way from position of the bridge to ends of the plate.

Observe the two following facts in the methods of Strad and Joseph:

(1) Thinnest point beneath all the strings is equally distant from position of the bridge, regardless of difference in weight and diameter of strings.

(2) Equal thickness of the plate beneath all strings, regardless of the difference in weight and diameter of strings.

At this moment I call only brief attention to the differences between this method for sounding-board thickness and the method, (my method) for yet greater evenness of tone-power.

The favorite method of Stradivari is:

(1) Thinnest point in the sounding-board is at the greatest practical distance from the bridge for all strings without regard to differences in weight and diameters of strings.

(2) Sounding-board thickness is equal beneath all strings without regard to difference in weight and diameter of strings.

Comparing the new method, thus:

(1) Thinnest point beneath the G-string is at greatest practical distance from position of bridge.

(2) Thinnest point beneath the D-string is less distant than for the G.

(3) Thinnest point beneath the A-string is less distant than for the D.

(4) Thinnest point beneath the E-string is less distant than for the A.

(5) At position of the bridge, greatest sounding-board thickness is beneath the G.

(6) At position of bridge, less sounding-board thickness for D than for G.

(7) At position of bridge, less sounding-board thickness for A than for D.

(8) At position of bridge less sounding-board thickness for E than for A.

This new method is based upon both fact and theory.

The fact is: Strings vary in weight and diameter; hence, force in string action varies.

Theory is: Sounding-board thickness beneath each should vary as the diameter and weight of strings; and, length of sounding-board activity beneath each string should vary as the pitch of tones demanded from each string.

For this fact, no proof is needed; it is self-evident; but the theory needs proof. As such proof, I first offer in evidence the fact, and a demonstration for the fact, that each string largely (not wholly) depends upon sounding-board activity directly beneath for augmentation of tone. For such demonstration, I offer this violin as a sacrifice. True, 'tis offering up but the one for the benefit of the many, yet, somehow I feel very much like a "wood butcher," that is, granting any feelings to the "wood-butcher." With this thin blade, I proceed to split the sounding-board of this violin in various places, and, shall continue such work until the tone of all strings is completely ruined.

(1) Beginning at the lower extremity of the right exit, I split the sounding-board down to the purfing. Application of the bow shows no damage whatever to tone of any string as following this split.

(2) Beginning at a point near to, and below the post, I split the sounding-board down to the lower end-block. Application of the bow again shows no damage to tone upon any string.

(3) Beginning near to, and below the bridge, I split the sounding-board along the center-join down to the lower end-block. Again, no damage to tone of any string.

(4) Beginning at the lower extremity of the left exit, I split the sounding-board down to the

purfing. Again, no damage to tone.

(5) Beginning at point even with the bridge, and to the left of the bar, I split the sounding-board down to the lower end-block. Although not what might be called complete ruin, yet, both G and D-tone now show serious damage.

(6) Beginning below the bridge, and to right of bar, I split the sounding-board down to lower end-block. Damage to G and D-tone is increased, but yet no injury to tone appears on A and E.

(7) Beginning at a point even with the bridge; and one inch to the left, I split the sounding-board upward to the purfing. From this split, there is only slight additional damage to G-tone, but, there follows no additional damage to D-tone.

(8) Beginning at the bridge, near to, and to the left of the bar, I split the sounding-board upward to the end-block. G-tone is now completely ruined, while D-tone, although injured, yet, is not totally ruined.

(9) Beginning at the bridge, and beneath the D, I split the sounding-board upward to the end-block. D-tone is now completely ruined, while A-tone, although injured, is not totally ruined.

(10) As before, splitting beneath A completely ruins tone of that string, while E-tone is but partially ruined.

(11) As before, splitting beneath the E completely ruins tone of that string.

Thus is clearly demonstrated the areas of sounding-board activity upon which each string depends for augmentation of tone-power; and their definite location proved to be of immense value to the production of even tone-power. It is evident that such location of areas pemits of precision in reduction of sounding-board thickness beneath each string proportionate to the diameter and weight of each string.

Thus far, proof is conclusive; but, the next step is a step in the dark. The question is, "What shall be the ratio of lengths for sounding-board activity best augmenting the tones of each string?"

The ratio for shortening the piano sounding-board cannot apply to the violin; nor in the entire range of musical devices can I find a ratio which may apply to the violin.

In stumbling through a text-book devoted to the philosophy of musical sound, I found a ratio for fifths of the major scale. This ratio at once attracted my attention, and, because it not only points out the difference in the number of vibrations per second for two or three consecutive fifths, but, for all possible fifths in the major scales. It is a constant ratio, That's the kind of ratio I now am wanting. The book states that multiplying the number of vibrations for any tone by 3-2, finds the number of vibrations in its fifth above. Wishing for certainty in this matter, I proceed to test the constancy of this innocent-looking ratio, 3-2. Helmholtz states—you know Helmholtz—he must be German—I think so anyway because he tells us more about the philosophy in musical sound than all other philosophers from all other countries jumbled together—Helmholtz states that open G, violin at concert pitch, vibrates 200 times per second; therefore, if 200 be multiplied by this easy ratio, 3-2, 'twill find the fifth above open G; 200, times 3-2 equals 300; 300, times 3-2 equals 450; 450, times 3-2 equals 675. These figures do represent the open tones of the violin, G, D, A, E. How easy! This philosopher business isn't much after all. Anybody can run it. Yes, if 3-2 works for music, it certainly ought to work all right for the violin; yet, I do recollect cases wherein there appeared no visible ratio of any size between music and the violin. But, as I'm wanting a constant ratio for lengths of sounding-board activity beneath violin strings, and, as no other ratio than 3-2 appears to fit the violin, therefore I'm bound to try 3-2.

Thus: Considering the greatest length of sounding-board activity beneath G to be 12 inches, therefore all that's needed to find such length for D is to use this innocent-looking ratio, 3-2, upon 12; and, 12 multiplied by 3-2 equals 18—what!—18 inches of sounding-board activity for D! Wish I could see Helmholtz for a minute.

In life there is a thing called misplaced confidence. Its location may be with others at times; at other times it may be with ourselves. The latter is the worst kind—we can't cuss Jones.

Yet, notwithstanding the fact of being led away by 3-2, I gave many a long month to search for a ratio which would apply to the length of sounding-board activity beneath the strings. But, in both waking and sleeping hours, wherever and whenever I looked for such ratio, there stood that 3-2 like the proverbial ghost. It would neither down, nor get up, nor go away; but remained as unruffled as a wooden Indian. I grew to hate 3-2; but, the more I hated it the more I had of it. In desperation, I searched for precedents giving relief from phantoms. I recalled successful treatment of others who were suffering from "phantoms," but, mine was not that kind. Late one sleepless night my long-looked-for precedent came. It was the precedent afforded by the captain of a Mississippi scow. This captain hearing about a new-fangled invention which was capable of fortelling approach of storms, invested good money in a barometer, and installed the same near the steering gear. Soon thereafter a great windstorm threatened to send this particular scow to the bottom. The barometer, not being in the wind-storm business, calmly rested in an indifferent manner. To the captain, the difference between a wind-storm and a thunder and lightning rainstorm cut no ice. Feeling himself the victim of misplaced confidence, the captain seized upon that impassive barometer and turned it up-side down. Here was my precedent. Because that captain thereafter made a successful "tie-up," therefore I jumped up, seized upon this impassive 3-2 and turned it up-side down. Then I slept.

I confess that this new ratio, 2-3, is a mere whim; but, the violin itself is a product of whims. During its first 200 years of development, the violin owes everything to whims; then; because two lucky whim-ers became genii, luck seems to have abandoned the class; that is, did we but trust the old violin promoter. I think by the 200-year precedent, 'tis now time for more luck.

LECTURE XV.

GENTLEMEN: Maximum evenness of violin tone is resumed. It is a wise provision of law that proof must precede conviction. It is sometimes wise to suspend judgement upon mere assertions until after presentation of proof, except those cases wherein proof is self-evident. Thus the statement that errors in graduation of the violin sounding-board operate to cause uneven tone-power is an assertion needing proof, because proof is not self-evident. The experienced violin tone-regulator understands such proof; but, as there are many interested in the violin without having any experience in tone-regulation work, therefore such proof is here presented.

In connection with the statement and proof that errors in sounding-board operate to cause uneven tone-power, it is interesting to note the wide variations in such thicknesses employed by the celebrated builders of 200 years ago; also, to note the wide variations by different writers concerning such thicknesses. From the evidence thus obtained it is clear that extremes in plate thickness were represented by Stainer, for greatest thickness, and by Stradivarius, and Joseph Guarnerius for least plate thickness, thus:

Stainer, at the position of bridge, 5 *mm*, down near the edges to 1 *mm*. Stradivarius, at the position of bridge, 2 and 8-10 *mm*, down near the edges to 2 and 7-10 *mm*. These figures are given by Simoutre, Paris, 1885, violin maker and collector. But, it is clearly in evidence that we should not consider these figures for plate thicknesses by Stradivarius as being the only figures employed by this tireless experimenter. Simoutre's figures are for a Strad of 1707; whereas Honeyman gives figures for plate thicknesses of a Strad, 1708, as 1-8 throughout the entire plate. It is thoughtful of anyone, when referring to a particular Strad violin, to give its date, because the date assists in making clear to the reader both model and plate thicknesses. To the experienced tone-regulator, it is at once apparent that the difference in plate thicknesses of the Strad, as given by Simoutre and Honeyman, operates to cause a difference in tone-pitch, and, in duration of tone. Thus, from Simoutre's figures, tone-pitch will be the lower, duration of tone greater, also, permitting use of lighter strings. Although this difference in plate thickness is but slight, yet it is ample to cause perceptible change in tone-pitch, duration of tone, and volume of tone, because plate thickness is down near to the limit of safety. By "limit of safety" is meant that degree of thickness below which weakness of tone follows.

There is another 200-year fact which seems worthy of presentation with the lighter 200-year sounding-board. Thus: Two hundred years ago, concert pitch varied according to locality, from A, 405 vibrations per second at Paris, to 451½ at Milan. It is but natural to connect the fact of low concert pitch at Paris with the fact that at Paris the Strad violins at once acquired a degree of favor never acquired in Italy. I mean violins of Strad's third period. This statement is based upon evidence of Italian musicians given to me personally. 'Tis but little more than a decade since "normal" pitch, or diapason normal, or international pitch was established with A at 435. It is a noteworthy fact that reducing concert pitch to A, 435, greatly accommodates those worn, weakened, originally light 200-year sounding-boards yet in use. 'Tis but natural for the student to ask, "When those old sounding-boards are gone, will concert pitch be raised?" This question possesses interest for every violin tone-regulator.

When a violin is carefully adjusted in sounding-board rigidity, bridge rigidity, quality, mass, and position of post for guage-2 strings tuned to A, 435, thereafter tuning A to 450, is but inviting disaster to tone-values. Again, when a violin sounds equally well at either pitch, such violin is not tone-regulated with care. From any point of view, 'tis but wisdom to settle down upon a universal pitch for all concert instruments, because then the violin builder might do tone-regulation with precision, thereby avoiding unmerited adverse criticism for putting out violins which will not stand at various pitches at the caprice of various conductors.

Neither in any 200-year sounding-board, nor in any later sounding-board have I found a method for graduation based upon the self-evident fact that force in violin strings varies as their diameter and weight. Considering evenness of tone-power to be a valuable feature of violin tone, and knowing that no 200-year violin builder made provision in sounding-board rigidity for diminished force in the lighter strings, I therefore discredit the oft-repeated statement that the violin reached perfection 200 years ago.

In proof of correctness in my position, I now present a method for sounding-board graduation based upon two facts, thus:

1. Force in violin strings varies as string diameters and weight.

2. Augmentation of high-pitched tones demand both shorter and lighter sounding-board fibers beneath them.

The violin world has stood still, and with its gaze fixed upon Cremona, while the piano sounding-board has developed such evenness of tone-power and such quality of tone as threatens to rob "the king" of its title. In this connection, the piano sounding-board possesses interest for the violin student. Its shortened fibers and diminished thickness from beneath bass strings to beneath the lightest and shortest strings is a broad hint to such violin devotees as can see nothing but "Cremonensis faciebat."

At a previous hour, a practical demonstration was submitted as showing that each violin string largely depends upon sounding-board fiber directly beneath for augmentation of tone. These three violins, designated by M. N. R. incidentally afford corroboration for the above fact; but at this moment, these violins are submitted as proof that unevenness in violin tone-power is caused by erroneous graduation of the sounding-board. Each of these sounding boards is graduated after a different method. For a purpose, the sounding-boards on M and N are given slightly exaggerated reduction in thickness. The sounding-board of R is given a thickness of $\frac{1}{8}$ throughout.

Violin M, graduated thus:

At bridge, beneath G and D, 9-64; thence down at ends to 4-64.

At bridge, beneath A and E, 4-64; thence down at ends to 4-64.

Violin N, graduated thus:

At bridge, beneath G and D, 4-64; thence down at ends to 4-64.

At bridge, beneath A and E, 9-64; thence down at ends to 4-64.

Violin R, graduated thus:

Thickness of sounding-board throughout $\frac{1}{8}$.

I will first apply the bow upon A and E strings of violin M. Beneath these strings, sounding-board rigidity is greatly reduced from position of bridge to ends of plate. It is apparent that a greater length of fiber-activity cannot be given to the 14 inch sounding-board. You observe that the fundamental tones of these strings are characterized by unusual volume, by low tone-pitch, by feeble intensity, and by freedom from noise. These effects upon tone are expected by the experienced tone-regulator; and, the explanation is found in the fact that diminishing thickness of a tone-producing agent, other dimensions remaining equal, lowers tone-pitch; that lengthening perpendicular, confined air columns lowers tone-pitch; that, as volume of tone increases, intensity of tone diminishes; that as power of tone diminishes, noise disappears. But, the next tone-phenomenon on these strings goes begging for an explanation. I now draw out two octaves upon each of these strings. As you observe, each successive, higher tone is characterized by increasing loss of power.

"Mr. Tone-regulator, please explain?"

"No?"

I know not where others may turn for this explanation; but, I turn to the modern piano sounding-board, and to the modern piano designer. I ask him, "Why do you constantly shorten fiber-activity beneath succeeding tones of higher pitch?" I am not surprised at his elevated eyebrows as he asks me, "Are you from Cremona?"

At this moment, G and D-string tones, violin M, have no further interest than baritone character and fair duration.

Violin N, sounding- board graduated the reverse of M, greatly changes tone-character of its G and D. The tone from these strings is also characterized by low pitch, by great volume, by feeble intensity, and by freedom from noise.

Of these three violins, R possesses much the greater tone-value. Only its *altissimo* tone-power is here in point. As I draw two octaves from this E, you observe perceptible diminution in power from successively higher tones. From the tone of these three violins, I reach the following conclusions:

1. In violin M, length of fiber-activity beneath A and E-strings is too great, and rigidity too great-

ly reduced.

2. Ditto, violin N, beneath its G and D.

3. Violin R, rigidity too great beneath its A and E. From my point of view, these violins afford conclusive evidence that erroneous graduation of the sounding-board causes unevenness in tone-power.

These violins also afford conclusive evidence that each string depends upon fiber-activity directly beneath for augmentation of tone; also, that length of fiber-activity should vary as the pitch of tones; also, that rigidity of the sounding-board fibers should vary as the force in strings. Standing out in a clear light, these reasons led me to work out a method for sound-board graduation intended as a practical demonstration for its value in securing maximum tone-evenness. As previously stated, this method was applied to but a single violin because my time for work came to an abrupt termination; but, you have my assurance that the results are encouraging in a high degree. I give assurance that, as a solo instrument, there is a vast difference in tone-values favoring that sounding-board having provision in rigidity for varying force in strings, and having provision in length of fiber-activity for tones of higher pitch.

By no means do I claim that the following details reach perfection; and I not only grant permission, but also request younger students to improve upon them. I do not claim 2-3 to be the best ratio for diminishing lengths of fiber activity beneath violin strings. I only claim 2-3 to be a ratio stumbled upon in an effort to banish that 3-2 ratio for fifths in our present-day major scale. Having presented the principles leading up to details for maximum evenness of tone-power, I now present such principles and details in condensed form.

These principles are:

1. Greatest thickness beneath G.
2. Thickness diminished from G to D.
3. Thickness diminished from D to A.
4. Thickness diminished from A to E.
5. Length of fiber activity greatest beneath G.
6. Length of fiber-activity diminished from G to D.
7. Length of fiber-activity diminished from D to A.
8. Length of fiber-activity diminished from A to E.

Thus, one of these principles refers or is applied to sounding-board thickness beneath each string; the other principle applies to length of fiber-activity beneath each string. In practical application of the latter principle, it is evident that fiber-activity beneath G, must be determined first. Here is another chasm across this path which I bridged with surmise or "guess." As you may have observed, there are emergencies besetting life's path for which the only recourse is "guessing." Of a truth, such emergencies may be found in the violin without use of the field-glass. In the matter of determining the precise length of fiber-activity in each violin sounding-board, I know of nothing reliable. From the evidence afforded by varnish phenomenon No. 1, I "guess" that one inch at each end of the sounding-board does not act with sufficient energy to produce audible sound. Basing conclusion upon this guess, the greatest possible length of fiber-activity is 12 inches. Taking this length of fiber-activity beneath G as a starting point, and, applying thereto the ratio 2-3, finds length of fiber-activity beneath the D, to equal 8 inches. Again, applying 2-3 to 8, finds length of fiber-activity beneath A, to equal 5, and 33-100 inches. Again, 2-3 of 5 and 33-100 equals 55/00 ~~2 and 77-100~~ inches as the length of fiber-activity beneath E.

Condensed thus:

Fiber-activity beneath G, 12 in.

Fiber-activity beneath D, 8 in.

Fiber-activity beneath A, 5 and 33-100 in.

Fiber-activity beneath E, ~~2 and 77-100 in.~~ 3 55/100

In using the term "fiber-activity" there is difficulty in making my meaning clear. It is clear that 12 inches of fiber-activity beneath G. is practically the limit; and, to secure this length, sounding-board thickness must gradually diminish from bridge-position to ends of the plate, and diminish down to a thickness which is the limit of safety. In the well known Stainer method, thickness at this point is reduced to 1 *mm*, or, 1-25 inch, and this point he places equally distant from the bridge beneath all strings. In my details herein presented, thickness at this point is only reduced to 4-64, or, 1-16 inch; and, this point varies in distance from the bridge by the ratio 2-3. Therefore, by the term "fiber-activity," I mean the distance above and below the bridge between two points of greatest reduction in sounding-board thickness. Thus, in the case of fiber-activity beneath D, one-half of the length, or 4 inches, is above, and one-half below the bridge position; ditto A, and E. But, because of placing the bridge 8 inches from upper end of plate, therefore bridge-position is not at the half-way point in the length of fiber-activity beneath G, 7 inches of such length being above, and 5 inches being below bridge-position.

Condensed thus:

Above bridge, fiber-activity beneath G, 7 in.

Below bridge, fiber-activity beneath G, 5 in.

Above bridge, fiber-activity beneath D, 4 in.

Below bridge, fiber-activity beneath D, 4 in.

Above bridge, fiber-activity beneath A, 2 and 66-100 in.

Below bridge, fiber-activity beneath A, 2 and 66-100 in.

Above bridge, fiber-activity beneath E, 1 and 38-100 in.

Below bridge, fiber-activity beneath E, 1 and 38-100 in.

(Obviously, those fibers beneath G and D, must receive identical treatment above and below the bridge; but, those fibers beneath A and E, do not necessarily need identical treatment above and below the bridge, because the post prevents action of those fibers from passing its position as previously demonstrated by splitting the lower right-quarter of the sounding-board. However, 'tis but natural to give identical care to thickness throughout the plate.)

Thus, the details for lengths of fiber-activity beneath the strings are presented. The difficulty in making these details stands out in a clear light, without aid of diagrams, is apparent. In this matter, failure will cause me no surprise; but, you may understand my willingness to be "interviewed." 'Tis the best I can offer.

Next come details for thickness. First, thicknesses are established at bridge-position. Before giving figures for thickness, it is necessary to explain that the grain of this sounding-board possesses slightly too great density to yield the "rich" tone; that they are faultless in every other feature; that this sounding-board has been in the service of two generations; that its shrinkage is completed; and, that its spring-action is superlative. Without these facts, the following figures for thickness might appear to pass beyond the limit of safety. By no means do I advise adopting these figures as thickness for all samples of sounding-board wood. With wood of softer grain, and with less time from the builder's hands, I would hesitate before reducing thickness to 4-64 at the ends of fiber-activity beneath the A and E, as per details.

In this case, desiring the baritone character for the G, thickness, at bridge-position, is reduced to 9-64; next, thickness, at bridge-position, beneath E, is reduced to 7-64; and, thickness is gradually diminished from G to E. Thus, immediately at bridge-position, some degree of provision is made for diminished force in the strings. Although the following table gives precise figures for thickness beneath each string at bridge-position, yet, change in thickness beneath the strings is not abrupt, but, is shaded down gradually.

Condensed thus:

Plate thickness beneath G, 9-64.

Plate thickness beneath D, 9-64.

Plate thickness beneath A, 8-64.

Plate thickness beneath E, 7-64.

(In sounding-board wood of soft grain, I have observed the thickness of 1-8, at bridge-position, to pass beyond the limit of safety, as shown by weakened tone-power in the D-string, often in both D and A. This phenomenon is worthy of attention. As a remedy for such weakened tone-power, I have met with considerable success from gluing a block of pine across the inner surface of the plate at bridge-position. The dimensions of the block are: Thickness, 1-8; width, 3-8; length, 3-4. Whenever weak tone in D and A; is caused by light sounding-board, this block operates to raise tone-pitch, and increase tone-power of the D and A, but, in nowise affecting tone of G and E. It is my conclusion that lightness of wood at bridge-position operates to lengthen fiber-activity beneath D and A, thus permitting action to pass between bridge-pedestals. Evidently, the block arrests action at bridge-position.)

In this experiment, thickness is equal at the ends of fiber-activity throughout; that is, 4-64. Referring to the table for lengths of fiber-activity, it is observed that, beneath E, the distance each way from bridge-position to the point where thickness reduced to 4-64, is but 1 and 38-100 inches; beneath A, but 2 and 66-100 inches.

I confess that such reduction at these points requires "nerve;" at least in my own case. But, I am careful that the thickness of 4-64 does not extend along the fibers to exceed 1-2 inch. Because these lengths of fiber-activity are determined by a constant ratio, therefore a line, drawn across their extremities, runs obliquely across the plate; and, along this line, thickness is reduced to 4-64; and, from bridge-position, thickness gradually diminishes down to such extremities. From 4-64 to ends of the plate, thickness gradually increases to 9-64.

Thus is the description of details which vary from customary details in sounding-board graduation. Treatment of the bar, being the same as heretofore described, is not here in point.

Doubtless, further experiment will discover a better ratio for lengths of fiber-activity. Had I been permitted more time for work, trial would have been given to 3-4 as such ratio.

However, 'tis but wisdom to trust that bridge which permits us to pass safely over it. The ratio 2-3 did serve me well, for equal evenness in violin tone-power mine ear hath not heard.

Good luck to you, little ratio.

May you meet your 200-year relatives in Cremona heaven.

LECTURE XVI.

GENTLEMEN: At this hour the subject of maximum violin tone-power is presented. Today the greatest power in violin tone attracts greater attention from violin users, violin builders, and violin students than at any other period in violin history. The cause for this fact is found in the increased seating capacity of the modern auditoria. Man is a gregarious animal, and a lover of music; and, for some occult reason, his enjoyment of music is as the square of his numbers. Without doubt, this fact is due to the geometric progression of sympathetic mental action. Thus, when but a single listener is present at rehearsal, sympathetic action remains at zero; a fact demonstrated by conspicuous absence of demonstration. Upon addition of another listener, sympathetic action develops as the square of two; whereat, the single listener becomes conscious of added enjoyment. To the musician, such increase in enjoyment by the listener is a greater stimulus than the stimulus of fine gold.

'Tis ever an object of human ambition to accomplish great feats. 'Tis the violin soloist's ambition to please his patrons in the larger auditoria equally with the patrons in the smaller auditoria. Such ambition is laudable, but, the difficulties are rapidly approaching the unsurmountable. Hence the "big" price for violins of big tone. But, the present demand for violins of "big" tone is an unnecessary weakness in violin users. From the thousands devoting their utmost energy to the violin, but a limited number ever will be called upon for an appearance in the larger auditoria. Only genius combined with almost superhuman drudgery can command widest patronage for the violin soloist of today. Thus, there is but a limited employment for violins of "big" tone; but, 'tis our weakness to bestow an admiring glance upon that party who says, "Your violin has a big tone."

'Tis said "we should take humanity as we find it;" but because of implied permission not to leave humanity as we find it, therefore I say that it is a compliment of vastly greater value when a competent party says, "Your violin has a beautiful tone." Such statement is based upon the fact that music is nothing if not beautiful. I do not mean that "big" violin tone may not be beautiful; but, do mean that distance of the listener should be proportionate to "bigness" of tone. In the smaller auditoria, in studio, or in apartment, "big" tone causes distress to the cultivated ear, no matter what the skill in bowing. These conclusions are based upon the general understanding of the meaning in the word "big" as applied to violin tone. Thus employed, "big" tone means marked volume of tone combined with marked intensity of tone. This combination is rare; and, to the best of my observation, is rare because of the rarity of sounding-board wood possessing superlative spring-action. This statement is based upon repeated failures to produce "big" tone at will. Thus, with every other factor at its best for augmenting volume and intensity of tone, yet, lack of superlative spring-action in sounding-board wood may defeat "big" tone.

In situations where space is proportionate, "big" violin tone may become agreeable. It is a fact that noise is disagreeable as its proximity. It is also a fact that the noise-wave, from all violins, travels only to comparatively short distances, except in cases of woody tone-quality. Because violins of marked woody tone-quality have no value, therefore such violins are not included in my meaning when saying that the violin soloist need not fear to appear in the larger auditoria with a modern violin possessing "big" tone, even when such tone is somewhat noisy in close proximity. There are some modern violins combining "rich" tone with marked volume and intensity of tone. When heard at a distance, it is my observation that but few ears are sufficiently acute to distinguish any difference between the tone of such modern violins and the tone of old violins yet possessing power.

Violin tone has ever and, and undoubtedly will ever remain separated into two classes by reason of two irreconcilable factors, as:

The business factor.

The æsthetic factor.

For its existence, the business factor has no other object than profit; and its income is reckoned in hundredths of a dollar.

The æthetic factor exists alone for human pleasure in beautiful sound; its income is a donation, and never reckoned at all. The difference in these two factors is as wide as the East is from the West.

The business factor dates from the mists prior to the time of Da Salo. The æsthetic factor dates from Cremona. The business factor always has been, and yet is numerically the stronger. The business factor demands the greatest possible volume, and the greatest possible intensity of violin-tone. The æsthetic factor demands greatest possible beauty in violin-tone; yet, to satisfy the æsthetic factor is a difficult matter. Violin æstheticism reckons not the cost.

To ordinary mortals, violin æstheticism seems sometimes to run into madness. Potency in violin æstheticism is second only to potency in religion. The potency in violin æstheticism created the Thomas Hall. 'Tis not at all necessary to state that said Hall is located at Chicago. The world learned of this fact by electric current.

Nor in New York, nor in Boston, nor in London, nor in Paris, nor in Berlin, nor in Vienna, nor in Milan, nor in the wide world is there a parallel object lesson for the potency in old violin æstheticism.

Only the potency in religion can pick up a similar million partly from beneath the feet of scrub women; and, such women exist only in Chicago.

Quartered many years in the Auditorium, the Thomas Orchestra found nothing for complaint except the fact that a large part of its patrons could not hear first-violin tone. Such complaint was well founded. At distant seats, conspicuous absence of first-violin tone was ample for disappointment; and, my heart cried out against the heartlessness displayed in forcing these old violins into a situation exciting contempt for their weakened tone-power.

There are three remedies for avoiding such disappointment, thus:

1. Replacing the deadening carpet of wood-fiber, wood-dust, or dirt within these old violins with a permanent, and perfectly smooth surface.

2. By substitution of modern violins having adequate tone-power.

3. By diminishing seating capacity of the auditorium.

With but an increase of 35 per cent in intensity of first-violin tone, the Thomas orchestra might have remained at home in the Auditorium for an indefinite period, thus avoiding acceptances from scrub women.

Naturally, substitution of modern violins having adequate tone-power suggests itself as the first remedy for the disappointment in not hearing first-violin tone. Herein lies the whole difficulty in this case. This suggestion points to the employment of the modern violin for interpretation of Haydn, Mozart and Beethoven scores, a possibility not admitted by Dr. Thomas. Over his signature, Dr. Thomas states that "the best of Cremona violins, together with the Tourte bow, inspired the master works of Haydn and Mozart." To this statement there is no dissent; but, to his statement that the Cremona violin is yet a necessary vehicle for the intepretation of master scores, there is dissent; and, such dissent comes from every disappointed patron. Were those older composers present at rehearsal in the Auditorium doubtless they also would join in such dissent.

Perhaps there is nothing concerning the "best" of the Cremona violins, (the Stradivari, to which Dr. Thomas particularly alludes,) more firmly established than the fact that the "best" are worn out by those disintegrating forces, heat and moisture; and, that "next best" are so nearly worn out as to possess but little value as vehicles for interpretation of either great or small compositions. It is safe to assume that none of these old violins possesses the same tone-vigor as on the day when inspiring the Haydns, Mozarts, and Beethovens of an hundred years ago.

The third remedy for removal of disappointment was chosen. This example of devotion to a delusion cost a round million; but, that million cost nothing more than stooping to pick it up. By all the logic in history and philosophy, another decade-and-a-half will bring yet another necessity for diminishing seating capacity.

In view of the abundance of modern violins possessing "rich" tone combined with ample tone-power, the statement of Dr. Thomas concerning 200-year violins as "necessary vehicles" seems to me like violin æstheticism run mad.

This digression is made for a purpose. First: To make clear the error in claiming the 200-year violin to be a "necessary" vehicle for interpretation of 100-year compositions. Second: To make the fact clear that the listener is in the better position to judge first-violin tone-values. Basing conclusions upon Dr. Thomas' statement, we are compelled to suppose that further interpretation of Haydn, Mozart, and Beethoven scores must cease with "the best of the Cremona violins." It is my conviction that this position by Dr. Thomas is the result of old violin æstheticism run mad; and further, that his position will be proven untenable in the near future. That Dr. Thomas' statement operates to excite contempt for the modern violin is clearly apparent; also, that his insistence in employing none but old violins by the Thomas orchestra operated to cause contempt for "the best Cremonas" as is in evidence by the disappointing experiences of an army of patrons. There is no question about interpretations by the large orchestra being intended for the pleasure of the entire audience, and not intended for the especial pleasure of the conductor and occupants of the front rows. There is also no question about disappointment coming upon the listener at not hearing first violin tone in the *ensemble.* I only speak for myself when saying that non-appearance of first-violin tone in orchestra *ensemble* is a non-artistic interpretation, whether the score be 100 years old, or but one hour old. In speaking thus, I do not mean that an offensive over-balance may be permitted to the strings. Mere loudness of violin tone without sweetness is offensive in both solo and orchestra violins. What I consider as the most valuable features in violin tone is moderate volume combined with sweetness, evenness of power, and marked intensity. Such combination of tone-qualities cannot become offensive to the listening ear; and, there is an ample supply of modern violins possessing such combination of tone-values for the needs of large orchestras called upon for interpretation of Haydn, Mozart, and Beethoven scores, or the scores of any master composer whatever. This point brings us to details for the production of maximum violin tone-power.

From my observation, each of the following factors must be at its best for the production of maximum violin tone-power:

1. Sounding-board wood: Superlative spring-quality.
2. Graduation: Form securing greatest force of blow upon contained air.
3. Back: Density, fine texture, sufficient rigidity.
4. Arching: Form producing maximum concentration of sound-wave movement at the exits.
5. Bar: Medium density, modeled for greatest spring-action, position.
6. Exits: Area, position.
7. Interior surfaces: Permanent smoothness.
8. Ribs: Depth, rigidity.
9. Blocks and linings: Solidity.
10. Post: Mass, density, length, fitting, position.
11. Cubic capacity of body.
12. Varnish: Quantity, quality.
13. Bridge: Mass, density, height, span, scroll-work, position.
14. Finger-board: Length, width, height, obli-

quity of under surface to exterior surface of sounding-board.

15. Strings: Diameter, proportion, number of strands, twist, material.

16. Bow stick: Length, weight, balance, cambre, spring-action.

17. Bow hair: Male equine, evenness, method of assembling.

18. Rosin: Quality, quantity.

19. Meteoric conditions: Moderate temperature, normal humidity.

20. Elevation above sea level.

21. Bow arm: Length, condition, training, enthusiasm.

From this list of factors, I place sounding-board wood at the head; and this conspicuous position is wholly due to the fact that I have not been able to produce maximûm violin tone-power without sounding-board wood possessing superlative spring-action, and also, because I have not been able to find such wood every month, nor every year, nor every decade. In fact, but a few times in fifty years search have I found such wood; whereas, the finding of hard wood possessing density, and fine texture has been comparatively a very easy matter.

Only limited observation is necessary to determine that neither softest wood nor hardest wood yield maximum resonance; but, widest observation cannot pre-determine that any given sample of wood will yield maximum resonance in the completed violin. Only after completion and trial can the degree of resonance be known for any violin from the hands of any maker whatever. Two samples of sounding-board wood may appear precisely similar; yet, in the completed violin, there may be a wide difference in resonance, even when details of construction are similar. Thus, the production of maximum violin tone-power becomes a matter of difficulty; and, such difficulty is chargeable to inherent variations in the spring-action of wood.

It is of interest to note the fact that violins of maximum resonance combined with "rich" quality of tone are rarities, even after 400 years of effort to produce them. Manifestly, there is some obstacle preventing production of such violins; otherwise, such violins would be in abundant supply. The cause for such rarity may not appear to others as it appears to me; but, all can agree upon the fact that such violins command a high price. In view of the fact that such violins are scarce today, we may safely presume that such violins will be scarce tomorrow, and remain scarce to an indefinite period. It is self-evident that the cause for such scarcity is something not subject to the command of man.

It is a fact of every-day demonstration that spring-temper, either in wood or metal, is something known only as a result of action following trial; and, such result cannot be pre-determined. Although the temperer of steel springs can produce either "high," or "low" degrees of temper at will, yet, to produce any given number of steel springs possessing precisely similiar action is a matter of difficulty; and, such difficulty arises from two causes: (1) Variations in molecular arrangement in different samples of steel: (2) Inability to pre-determine such variations. In practice, it is clearly demonstrated that imperceptible variations in density, or hardness of the steel spring, produces perceptible variation in spring-action. Also, that value of the steel spring depends upon its temper, or hardness, or density, whichever term may be chosen.

Naturally, we wonder what would be the result could violin sounding-board wood be given "temper" to the limit of desire.

Shade of Colossus!

Why then, the present-day violin of "big" tone would'nt do for the baby; and, the largest auditorium would'nt do for a stage; and, the gender of Music would needs be changed to "he;" 'twould kill "her;" and, "he" must needs be deaf.

Find users?

Believe it.

As I view this matter, Nature wisely limits man's possibilities——in the violin.

What I shall say about appearances of sounding-board wood promising maximum resonance of tone, combined with "rich" quality of tone, is presented only as the observation and conclusion of one individual; and, such conclusion is in nowise presented as a hard-and-fast rule. Upon the matter of resonance in sounding-board wood, I am bound to confess that infinite surprises have awaited my bow. It is observed that *maximum resonance* of tone is combined with *richness of tone.* I desire that this combination be kept in the foreground; because, loudness without sweetness reduces violin tone-value to insignificance. No fact concerning violin tone stands more clearly in my view than the fact that sounding-board grain may be so dense as to make "rich" tone an impossibility; whereas, mere loudness of tone follows with ease.

From the softer grades of pine, "rich" tone may be secured with considerabe certainty; but, from those grades, marked power of tone is impossible. Again the fact is noted that great volume of tone does not mean great intensity of tone. Great volume of tone may be obtained from the softer wood; but never great intensity of tone.

The vast difference between volume of tone and intensity of tone is brought out into the lime light by the long-distance test in open air. This test demonstrates conclusively that great volume of tone is not neccessary for great power of violin-tone. Indeed, I have not observed great volume of tone and great intensity of tone existing together in the same violin.

In my observation, the physical appearances of sounding-board wood yielding the maximum resonance combined with "rich" tone-quality are thus:

Genus pine.

Maturity of tree before being felled.

Sample free from heart-wood and sap-wood, knots, curls, cracks, and discolored spots.

Grain perfectly straight, uniform in width, neither wide nor extremely narrow.

Color, yellowish red.

Connective tissue, between dense parts of grain, rather soft and flexible.

Hard part of grain distinctly marked.

Wood easily subject to splitting.

Splits follow a straight line.

Shavings rather brittle than tough.

Shavings easily split up into threads.

Difficulty in securing a smooth surface.

Medium transmission of artificial light.

Plate rather pliable than rigid.

Bent plate returns to its point of rest with celerity.

Unprotected, heat and moisture rapidly develop a carpet of wood fiber.

Disintegration comparatively rapid.

Medium density of grain.

Thus are the physical qualities of my ideal sounding-board wood. Such wood, with correct models of arching, correct graduation, correct area and position of exits, and with permanent and perfectly smooth interior surfaces yields ample intensity of tone for all practical uses of the violin, besides yielding "rich" tone. As you remember, "rich" violin tone depends upon the presence of harmonic overtones, and harmonics *a bassa*, or *resultant* tones; and, that such harmonic tones cannot be coaxed into an appearance by the sounding-board of dense grain.

There are degrees of density between the medium and the extremely dense which possess considerable value; and, in situations where noise abounds, the sounding-board of more than medium density possesses the greater value. In such situations, those ethereal tones called harmonics are annihilated; even the principal tone may have to struggle for existance; therefore, the sounding-board possessing greatest power in spring-action gives the greater satisfaction in the presence of noise.

But, I do not find increasing density of sounding-board wood to be continually followed by increasing power of tone. On the contrary, I find weakened tone-power following extreme density. This result might be pre-supposed; and, because increasing density is followed by increased rigidity; and, increased rigidity is followed by diminished amplitude of oscillation; and diminished amplitude of oscillation delivers a blow of diminished force upon contained air; hence weakened tone follows.

Method of graduation has much to do with violin resonance. At this moment, graduation of the sounding board is in point. Thickness of the sounding-board may be so great or so reduced as to cause weakness of tone. As precise figures for violin-plate thickness are unreliable guides, therefore such figures are not presented. In my experience, it is clearly demonstrated that sounding-board thickness, producing greatest force of blows upon contained air, vary with each sample of sounding-board wood; and, for this reason, hard-and-fast figures for thicknesses are unreliable guides more frequently leading to disaster than to success.

It is apparent that rigidity of the sounding-board should be determined by the force in the strings, since blows of the strings must be the only reliance for arousing sounding-board action. Therefore, the gauge of strings must be first determined, and thereafter, rigidity of sounding-board, in each violin, must be reduced to that degree delivering the maximum blow upon contained air, and, such degree of rigidity can be determined only by trial. Manifestly, for certainty in this matter, there is no alternative.

The point is to know when each sounding-board is delivering its maximum blow. For this matter, I know of no hard-and-fast rule, unless it be the rule that experience must govern. I can truly say that much experience in reducing sounding-board rigidity leads one to err on the safe side rather than incur disaster by too great reduction of rigidity. It has been my experience that, when the exact degree of rigidity is secured, the further removal of thinnest shaving weakens the force of blow upon contained air.

For securing the maximum blow upon contained air it is necessary that the extent of both normal and transverse vibratory action in the sounding-board be given most careful consideration.

(See Appendix for explanation of normal and transverse vibration.)

As these actions are aroused by blows of the strings, and, as the strings vary in diameter and weight, therefore, rigidity of the sounding-board must vary with the force of the strings for production of maximum tone-power. As force in the E-string is less than that of the A, A less than D, and D less than G, therefore, it is not reasonable to expect maximum vibratory action to follow that method of sounding-board graduation giving equal rigidity of wood to all strings alike.

In discussing that vibratory action which travels across sounding-board grain, the terms "transverse" and "tangential" may be interchangeably employed, since practically, each term has the same meaning. In practice, increasing the distance traveled by transverse vibration in the violin sounding-board operates to increase volume of tone; and, such increase in volume of tone may be carried to a degree causing loss to intensity of tone. In the production of maximum tone-power this point is of great importance; because great volume of tone does not mean great power of tone. Great power of tone means the distance traveled by tone.

In the violin sounding-board, the distance traveled by transverse vibration depends upon three factors:

1. Power of strings.
2. Rigidity of the plate along lines at a right angle with the center-join.
3. Density of grain.

Manifestly, it is necessary to determine first upon the size, or gauge of strings. Second, to diminish rigidity along lines at a right angle with the center-join to that degree permitting the strings to propel transverse vibration as far from the center-join as desired. Some violin makers reduce rigidity along these lines to a degree permitting force of the strings to propel transverse vibration to the edge of the plate. This plan invariably operates to increase volume of tone; but, it also operates to diminish intensity of tone; and, the reason for such loss to intensity is clearly due to dispersion of string-force. It is my observation that, to produce maximum violin tone-power, string-force must be concentrated rather than dispersed; and therefore I limit the distance traveled by transverse vibration.

[It is necessary to bear in mind the fact that I employ the gauge-2 string, because, were larger strings employed, greater force would be present; hence greater distance of travel might be safely permitted to transverse vibration.]

There are two methods for determining the distance to be traveled by transverse vibration in the violin sounding-board after its thickness has been nearly reduced to the final degree, thus:

1. By removal of wood from the interior surface before assembling.

2. By removal of wood from the exterior surface after assembling and stringing up.

With the first method, results depend upon guess-work when working upon new and untried wood. With the second method, results are certain; because with the strings in tune, their force may be tested until transverse vibration reaches any desired point upon lines at a right angle to the center-join.

For concentration of string-force upon the sounding-board, the following method for diminishing thickness has been the most successful in my experience; because, with this method, I could limit the distance traveled by transverse vibration at the point yielding what I call sufficient volume of tone without the greater dispersion of string-force; and, the result has been moderate volume of tone with marked intensity of tone, a combination invariably reaching the greater distance in the out-of-doors long-distance test.

Thus: Greatest thickness at bridge-position; thence, thickness diminishes gradually to a point half-way from bridge-position to ends of plate; from such point, thickness increases gradually to ends of the plate; and, from such half-way point, on lines at a right angle with the center-join, the same thickness at such point is secured along such lateral lines to a point one and one-fourth inches to the right, and to a point one and one-fourth inches to the left of the center-join; and, from these points also thicknesses gradually increases in either direction from these lateral lines.

Next, the violin being assembled, and the strings in tune, the force of the strings is tested. Intentionally, the sounding-board is too rigid as assembled, as a matter of precaution.

Now comes work in which science cannot become a substitute for musical sense; neither can the world's wealth purchase one grain of musical sense. Musical sense is in nowise a commercial commodity. Musical sense cannot be borrowed.

There's the trouble.

I can borrow my friend's books, and promptly forget to return them; but, I shall never have the chance to forget the returning of his musical sense.

Upon testing the tone from the newly assembled violin, and finding duration of tone to be too short to suit my taste, then I increase the distance traveled by normal vibration; and, accomplish such result by diminishing the thickness of the sounding-board from the half-way lateral line noted to ends of the plate; and, if I find volume of tone yet too small, then I increase distance traveled by transverse vibration; and accomplish this result by diminishing thickness at, above, below, and outside of the lateral points noted; and, to give an equal chance for the force in the A and E-strings, thickness immediately beneath those strings is diminished.

In working upon new and untried wood, I repeat notice of the wisdom in erring upon the safe side rather than diminishing thickness until weakness of tone follows. This precaution is made necessary by increased flexibility of connective tissue inevitably following use. I have known such increase of flexibility to ruin tone-values in two years use.

In the work of regulating sounding-board thicknesses with the object of maximum tone-power in view, it is of importance to bear in mind the fact that sympathetic action between vibrating bodies diminishes as the square of the distance; therefore, thicknesses in the lower half of the sounding-board should be less than in the upper half.

So far as work upon the sounding-board itself is concerned, these details include the main features; but, as the previous list shows, there are many other factors necessary in the production of maximum violin tone-power. Because the more important factors in the list have been presented upon preceeding pages, therefore extended notice of them is unnecessary at this moment further than to say that, in my experience, no factor in the list can be neglected without inviting disaster. There are numerous examples, other than the violin, showing the disastrous effects due to dispersion of force. The horn, too light in metal, yielding, trembling, "buckling" before the force from the player's lungs, loses tone-power. Instead of controlling the elastic energy of air molecules within, it is itself controlled.

Again, the steam whistle yields but a harmonic tone when the pressure of steam greatly exceeds rigidity of the whistle.

Again, the piano, with sounding-board too light, delivers but a weak tone; a result clearly due to dispersion of force.

Again, the ball, thrown against the hanging canvass, falls straight to the ground; a result due to dispersion of force.

Again, the loud voice, directed upon the telephone diaphragm, causes indistinctness at the receiver; a result due to dispersion of force.

Again, the orator, in open air, can be heard only at limited distances owing to dispersion of force.

Again, the fowling-piece, recoiling, loses range.

Of these examples, it may be said, force is too great.

True, from one standpoint, not true from another standpoint. The violinist, never wanting greater tone-power than that produced by the weight of his bow, is not pleased with the violin requiring vigorous bow-pressure. To please such violinist, the violin maker must make a violin of light weight; and such violin is not pleasing to the violinist whose bow-arm possesses vigor and enthusiasm, because the light-weight violin, subjected to vigorous bow-pressure, trembles to that degree permitting too great dispersion of string-force; a degree of dispersion resulting in weak tone.

Loss of power is not the only affliction brought upon the violin by too light wood. A more disastrous affliction is woody tone quality; the kind coming from hard wood when its rigidity is too greatly reduced.

I have seen violins, built with the best of intentions, yet ruined by too great reduction of rigidity in the hard-wood plate. Such violins, under light bow-pressure, and with light strings, may yield a quality of tone to be tolerated; but, under vigorous bow-pressure, the tone is intolerably woody. As a musical instrument, such violin sinks below insignificance.

LECTURE XVII.

GENTLEMEN: Philosophic reasons for the permanent and perfectly smooth interior surface of the violin are clearly defined and easily comprehended. After long years of observation upon this subject, it seems to me unnecessary to present the reasons for protecting interior surfaces of the violin from such disintegrating forces as heat and moisture. It also seems unnecessary to present reasons for augmenting tone-power by the perfectly smooth interior surface; but, remembering my own doubts upon these points previous to observations, therfore I assume that others, who are considering these points for the first time, may also entertain similar doubts.

At first, my own doubts would not permit trial of this experiment upon violins of value; nor did I try it upon violins of value until after several years of observation. At this moment, I find myself wondering why the violin world should fear protection for interior violin surfaces more than for exterior surfaces. That such fear exists to a wide extent is well known; but the reasons for such fear are not altogether clear; some holding to one objection, some to another. Perhaps the most universal objection is due to fear that interior protection may be disastrous to tone-quality. The owner of a violin possessing superior tone-quality cannot be blamed for entertaining such fear, and, because violins of superior tone-value are comparatively rare, Were such violins as common as violins of inferior tone-quality, then the case would be different. Again, the case would be different could violin users live long enough to see new violins wear out under their own bows. Thus, at the moment of knowing a valuable violin to be on the downgrade, the owner would willingly adopt any reasonable method for prolonging its usefullness. But, the wearing out of a violin within a single life-time is a rare occurrence.

Basing calculations upon equal use, no argument is needed to determine that of two violins, built from the same sections of hard-wood and soft-wood logs, the one lighter in wood is destined to the briefer period of usefullness. It is my own vivid recollection that when sounding-board rigidity is reduced to that point producing greatest augmentation of tone, thereafter but slight loss of wood by disintegration operates to diminish tone-power; and such loss, steadily continuing, because disintegration steadily continues, may bring ruin to superior tone-value within a single lifetime. Thus, we may expect immediate diminution of tone-value from such new violins as possess superior tone-power at the moment of leaving the builder's hands. Again, and for the very reason of steadily continuing disintegration upon unprotected interior surfaces, we may expect increasing tone-power from such new violins as are slightly heavy in wood at the moment of leaving the builder's hands,

'Tis but human to desire immediate superiority in violin tone-values.

Life is too short to wait for slow disintegration. Once possessing superior violin tone-values, 'tis but human to mourn for the loss of them.

To prevent such loss is but simplicity itself.

I feel a pang of regret at every thought of those wrecked gems strewn along the violin's path; and, because nearly everyone of these wrecks, due to disintegration on interior surfaces, might have been preserved to an indefinite period.

The details for violin interior surface protection, as best known to me, have been presented upon previous occasions; but, in such presentation, I hesitated to discuss the principles of philosophy involved therein. My hesitation was due to the fact that but comparatively few violin users care for the philosophy involved in either the production or preservation of violin tone. It is quite safe to assume that all violin users are keenly alive to find brief and positive assertions that this thing or that thing, this method or that method infallibly produces certain results in violin tone. It is my observation, that even today, after the violin has been an object of attention during 400 years, none can formulate infallible rules for the production of greatest tone-values. When the day of such infallible rules arrives, violins of greatest tone-values will be as common as are violins of inferior tone-values today. The cold fact remains that, to make violins of faulty tone is of the utmost ease and certainty; whereas, to make violins of faultless tone is a matter of the utmost difficulty and uncertainty. Such uncertainty is due to the impossibility of formulating rules governing all phenomena in violin tone. Concerning the cause for such impossibility, there is disagreement between philosophers of 50 years ago and philosophers of today. Today, the majority hold the opinion that such impossibility is due to the capricious action of sounding-board wood. My own experience decidedly lends corroboration to this opinion. It is my belief that today, given sounding-board wood of best quality, violins of best tone-values might be produced indefinitely.

It is self-evident that the builder, even when given the best of wood, must necessarily be master of all other factors operating to modify violin tone.

In my work upon the violin, it has been an object to separate and classify all factors concerned in the production and modification of violin tone thus:

Class 1. Factors constant in tone-results.

Class 2. Factors not constant in tone-results.

The following tone-modifying principles, being constant in results are placed in Class I, thus:

1. Lengthening a tone-producing agent, other dimensions remaining equal, lowers tone-pitch.

2. Shortening a tone-producing agent, other dimensions remaining equal, raises tone-pitch.

3. Increasing thickness of a tone-producing agent, other dimensions remaining equal, raises tone-pitch.

4. Diminishing thickness of a tone-producing agent. other dimensions remaining equal, lowers tone-pitch.

5. Lengthening perpendicular, confined, air columns lowers tone-pitch.

6. Shortening perpendicular, confined, air columns raises tone-pitch.

7. Position of violin exits, distant from points of sound-wave concentration, diminishes volume of tone, and intensity of tone, and noisy tone-quality.

8. Increasing area of violin exits raises tone-pitch, increases volume of tone, diminishes intensity of tone, and accentuates noisy tone-quality.

9. Diminishing area of violin exits lowers tone-pitch, diminishes volume of tone, increases intensity of tone, and diminishes noisy tone-quality.

10. Roughened and carpeted interior surfaces of the violin diminish volume of tone, intensity of tone, and noisy tone-quality.

11. Perfectly smooth interior surfaces of the violin increase power of tone, and accentuate noisy tone-quality.

The following tone-modifying factors, not being constant in action, are placed in Class II, thus:

1. The finger-board.
2. The bridge.
3. The sounding-board.
4. The post.
5. The back.
6. The bar.
7. The blocks.
8. The ribs.
9. The linings.

Some of the modifiers in Class II nearly approach constant action, or lack of action rather, as the finger-board, blocks, ribs and linings; but, because of lacking constant effects upon tone in any degree, therefore they are placed in this class. [At the moment of making up the list in Class II, I discovered that the effect upon tone, due to the ribs, linings and blocks, has not heretofore received attention. Because of this omission, I am now thinking there yet may be other omissions. The difficulties under which I work are offered as an excuse. It is my observation that the benefit to tone from the ribs, linings and blocks consists in preventing violent trembling of the violin. Because such trembling weakens tone, therefore weight and rigidity in these modifiers is their measure of value to tone; and, this measure is therefore a measure for their lack of action.]

It is observed that all tone-modifiers in class I, depend wholly upon the action of air; therefore, without the shadow of doubt, their constant effect upon violin tone is due to the fact that the action of air is a constant quantity. The first six tone-modifiers in class I, affect only the single tone-quality of pitch; the seventh affects three qualities of tone; the eighth and ninth, four tone-qualities each; the tenth and eleventh, three tone-qualities each.

At this point, it is interesting to note the number of tone-qualities at the absolute command of the builder. I find this number not great enough to be flattering. Enumerating tone-qualities entering into "rich" violin tone, I find their number to equal 12, thus: Pitch of tone, volume of tone, intensity of tone, evenness of tone, freedom from dissonant overtones, or noise, sympathy in concert, responsiveness to bow-pressure, agreeable double-stop tones, harmonic tones, resultant tones, or harmonics *a bassa*, brilliance in velocity, human quality of tone.

[Nobility of tone, and liquidity of tone strongly appeal for place in this list, but, as nobility of tone depends upon tone-pitch and volume of tone; and, liquidity of tone depends partly upon tone-pitch and partly upon brilliance of tone, therefore they are not given place as individual tone-qualities.]

Out of the 12 individual tone-qualities given, I have found but two which are absolutely at command of the builder at all times. Those two are the qualities of pitch and volume. Thus, no matter what the tone-value of wood may be, violins equal in tone-pitch, and, equal in volume of tone may be reproduced indefinitely. To reproduce the remaining 10 individual tone-qualities at will, and at all times is wherein lies a great difficulty. Of the remaining number, I find three which are approximately at command of the builder, namely, intensity of tone, evenness of tone-power, and freedom from dissonant overtones.

Intensity of violin tone is found to be a product of four factors, thus:

1. Arching of plates.
2. Position and area of exits.
3. Condition of interior surfaces.
4. Inherent spring-action of sounding-board wood.

It is apparent that three of these factors are at command of the builder at all times; but, the fourth factor is not at command at all times. Inherent spring-action of sounding.board wood, being a capricious quantity, operates to defeat equality in the carrying power of different violins. Only in an approximate degree can the experienced worker in sounding-board wood predetermine the tonal-quality of any given sample. Tonal quality of wood can be determined only by trial; but, the builder can secure considerabe intensity to violin tone by arching, by area and position of exits, and by condition of interior surfaces. Even with sounding-board wood lacking much of possessing superlative spring-action, it is my observation that greater tone-intensity can be secured by the perfectly smooth interior surface than with sounding-board wood possessing superlative spring-action while interior surfaces remain rough and carpeted with wood-fiber, wood-dust and dirt. But, the 80 per cent. increase in intensity of tone, as recorded, should not be taken as an amount of increase wholly due to the perfectly smooth interior surface. This record was secured to six common violins selected from a general stock, and their average carrying-power was first determined without change of their conditions; and, the 80 per cent increase in carrying-power was secured after such tone-modifiers as graduation, bar, post, depth of ribs, linings, blocks, condition of interior surfaces area of exits, finger-board, bridge, varnish, and strings had received my utmost attention. Thus, the per cent of increase in intensity of tone, due to the perfectly smooth interior surface alone, does not appear in the record, nor have I made experiment with this factor alone. The precise value of this important factor for augmenting intensity of violin tone ought to be determined, because of its interest to owners of old violins having tone-qualities right in every way except in the quality of intensity.

Although removal of the dust-carpet from interior surfaces of the violin, by such agents as shelled corn, wheat, or oats, is better than no removal at all, yet, there are violin owners who have not the courage even to permit entry of these harmless agents into that sacred interior. So far as my observation extends, such fear is caused by the expectation that noisy tone-quality may follow. It is a fact that there are cases wherein such fear has good ground for existence. Thus, when a violin is afflicted with noisy tone-quality, placing a carpet upon its interior surfaces does operate to "improve" the tone; and, because whatever operates to diminish tone-power may operate to annihilate noise. This phenomen in tone is due to the fact that the noise-wave is inherently weaker than the music-wave; hence, the noise-wave is first to disappear.

The permanent, and perfectly smooth interior surface appeals only to such violin users as desire greater intensity of tone. To them, the philosophy involved in this question possess interest; and, to them I now address myself.

In discussing the principles of philosophy pertaining to violin interior surfaces, it is interesting to note certain facts concerning air itself, thus; In all countries, philosophers agree that air, surrounding earth, exists as gases; that such gases are in the form of spheres; that each sphere is a molecule; that such molecules are too small for measurement; that they touch each other as shot; that they are compressible; that when released from compression, they resume the spherical form with energy; that force is communicated from molecule to molecule by their expansion and contraction; that, in unconfined air, energy is dispersed equally in all directions; that such lines of dispersion may be concentrated by confining walls; that concentration of such lines increases distance traveled by the energy in the original blow; that such energy may be reflected from solid, smooth surfaces without loss of force; that such energy is not only arrested, but, may be totally annihilated by striking upon soft bodies; that force of the original blow travels at a right angle to the striking surface; that such line of travel, striking upon a solid, smooth surface, is reflected at an angle equal to the angle of incidence; that volume of sound is proportionate to the number of molecules affected by the striking agent together with the amount of force in its blows; that intensity of tone, (carrying power of tone,) is proportionate to the force of blow and the degree of concentration given to lines of sound-wave travel; that the distance traveled by sound-waves may be diminished by conditions of reflecting media, and by meteoric conditions.

Other qualities of air, not being in point are omitted. Each of these facts concerning air is directly connected with the production of violin tone.

The infinitely small size of the air molecule possesses vast interest to the violin student. This interest centers in the fact that unprotected, interior surfaces of the violin cannot be made perfect reflecting media for lines of sound-wave movement. Beneath the magnifying glass, and at the limit of polishing, these surfaces yet present ridges, valleys, and open mouths of caverns. It is self-evident that each of those ridges and valleys operate to abruptly deflect lines of sound-wave movement; in other words, to defeat equality in the angles of incidence and reflection; that those open caverns operate to annihiliate sound-wave movement; that those disintegrating forces, heat and moisture, operate to sharpen those ridges, to deepen those valleys, and to increase the capacity of those caverns; that all of such agents acting upon interior surfaces of the violin, combine to diminish concentration of sound-wave movement at the exits; that such diminution defeats intensity of tone; that all of this effect upon tone is due to the infinitely small size of the air molecule, and to the infinitely rough, unprotected surfaces within the violin.

From the permanent and perfectly smooth interior surface, the value to intensity of violin tone-power is plainly apparent.

It is also apparent that to secure such surface, dependence must be placed upon a protecting agent susceptible of taking a high polish.

Aside from intensity of tone, there are, in this connection, other effects possessing interest to such violin users as desire maximum tone-power. I allude to such effects as are produced by:

1. Times of sound-wave reflection before reaching the exits.

2. The solid, or yielding back as a reflecting medium.

3. Condition of the striking surface.

It is my observation that the number of times sound-waves are reflected before reaching the exits exerts very perceptible influence upon both brilliance of tone, (meaning distinctness of tone in rapidity of succession,) and power of tone. Obviously, times of reflection may be so great as to diminish force in any projectile; also, it is obvious that times of reflection operate to delay any projectile in reaching a given point. In the violin, these principles are demonstrated by the method of sounding-board graduation. Thus, when reduction in thickness places the point of widest amplitude of oscillation near to ends of the plate, then both brilliance of tone, and power of tone are diminished. It is self-evident that the greatest force in blows from the plate is found at the point of widest amplitude of oscillation; also, that times of reflection of sound-waves increases as the distance from point of origin to exits. Oft repeated experiment in locating the point of widest oscillation has led me to the conclusion that to this method of sounding-board graduation, maximum power of tone is an impossibility. In such experiments, it was conclusively shown that placing the point of widest oscillation half way from position of bridge to ends of plate produced maximum tone-power. From my view point, the increase in tone-power following the latter method of graduation is due to two facts, thus: The widest oscillation, possible to sounding-board fibers, can be secured only at a point half-way from the bridge-position to ends of the plate; and, shortening the distance from the point of origin to the exits, by diminishing times of reflection, diminishes both delay and and loss of force to the sound-waves receiving the greater blow; hence, greater brilliance of tone, and greater tone-power.

It is an easy matter to demonstrate on paper that, as arching increases, times of sound-wave reflections diminish. Indeed, this proposition is self-evident, thus: In the box fiddle, the plates are parallel, hence, sound-waves, originating at the top plate, and traveling at a right angle to the striking agent, according to the law, must touch the back at a point perpendicular to the point of origin; therefore, the reflected wave must travel back to the top plate directly upon the line of incidence; hence, there is no progression of sound-wave movement toward the exits. If the top plate alone be given but the slight arching of $\frac{1}{8}$ then sound-waves, originating therefrom, will not touch the back at a point perpendicular to the point of origin, but, will strike at a point nearer the exits; and, will be reflected at an angle equal to the angle of incidence according to law. Thus, sound-wave movement, at each reflection, approaches the exits; but, in this case reaches the exits only after many times reflection. If now the back be given an arching of 1-8, times reflection are diminished by 1-2. It is thus apparent that times reflection diminish as the height of arching; but, it does not follow that tone-power follows an indefinite degree of arching because increasing the heighth of arching increases resistance; therefore the arching of violin plates may be so great that force in the strings cannot overcome such resistance.

Experience, and but experience, determines that when widest oscillation of sounding-board fibers is placed near the ends of the plate, the arching, at bridge-position, should not be less than $\frac{5}{8}$ to secure satisfactory brilliance of tone; and, when the point of widest oscillation is placed half-way from bridge-position to ends of the plate, then arching should not be less than $\frac{1}{2}$ inch. It was previously shown that the less the heighth of arching, the greater the susceptibility to force, therefore heighth of arching becomes a factor in the production of maximum tone-power.

As the sounding-board strikes the blow upon contained air to produce sound, therefore its striking surface possesses interest in this connection. It is evident that force in any blow may be diminished by a soft carpet upon the face of the striking medium. Thus, when the interior surface of the sounding-board is covered with a carpet of finely slivered wood-fiber, force in its blows upon contained air is diminished in proportion to the thickness of such carpet; or, stated in the reverse way, force in its blows is augmented by the permanent, and perfectly smooth interior surface. In this connection, the back plate possesses interest aside from the condition of its interior surface. As previously stated, I find myself able to secure greater intensity of tone by treating the back solely as a reflecting medium. Thus, rigidity in the back, sufficient to stand firmly against the force in charging sound-waves, becomes a feature of value. But, whether or not the strong back stands still in the presence of such charge, I do not know. I only know that violent trembling of the back operates to diminish intensity of tone, as is easily demonstrated by the long distance test in open air. Right here is a fact possessing double interest, thus: In making the long-distance test for carrying power, powerful bow-pressure is employed; therefore, the back is called upon to stand before the limit of force within that particular sounding-board; and, yielding of the back to such amount of force operates to diminish the recoil in air molecules. It is apparent that such recoil diminishes as the yielding of the back, and as yielding of the back diminishes with the diminished force in charging sound-waves, therefore, with diminished bow-pressure, such violin displays greater carrying power than with greatest bow-pressure. This phenomenon may be observed frequently. So far as assistance in orchestra *ensemble* is concerned, such violin is worthless; and worthless because its tone is smothered by sound-waves from harmony instruments. Many times have I demonstrated the fact that replacing such weakened backs by others possessing rigidity operates to increase intensity of tone. It seems clear to me that rigidity in the back should equal the limit of force in the sounding-board, even when the sounding-board is aroused to its widest oscillation by action of the open strings under greatest bow-pressure; and, because only thus may the limit of bow-pressure be employed without disaster to carrying-power.

I will demonstrate the reason for such conclusion by the action of this elastic ball as it rebounds from yonder brick wall, and, from yonder partition wall of light wood, As the ball is thrown against the brick wall, the distance to which it recoils is proportionate to its force at the instant of impact; thus, the greater its force, the greater its recoil. But, from the partion wall of light wood the result is widely different. Beginning with moderate force to the ball, and gradually increasing until its force equals rigidity in the wood, the distance of recoil increases as the amount of force; but, upon giving to the ball an amount of force exceeding rigidity in the light wood, the distance of recoil is greatly diminished. It is apparent that yielding of the wall robs the ball of its elastic energy. Air molecules are elastic balls; and, the yielding violin back robs them of a chance to display their elastic energy; hence, diminished carrying power. But, did rigidity in the wall exactly equal the greatest force given to the ball, then the distance of recoil would have exceeded former distances, because elastic energy in the wood, added to elastic energy in the ball operates to increase the distance of recoil. Form the action of the partition wall, it is apparent that such great increase in distance of recoil is possible only to *one certain amount of force* in the ball; a less amount of force not being able to arouse the same degree of energy in the wood; while a greater amount of force in the ball causes yielding of the wood with its disastrous results.

Right here is a point of vast interest to the violin student.

'Tis the old question of regulating violin tone-power by work upon the back plate. The following conclusions, although based upon repeated practical demonstrations, are presented only as the conclusions of one individual; and, such conclusions may have to stand without support from others. It is my observation that rigidity of the back may be so determined as to augment the fundamental, or open tones of each string; but, in no instance have I observed equal augmentation following for any other tones. The reason for this phenomenon seem clearly indicated by action of the ball and the light partition wall. Thus: When force in the ball exactly equals spring action in the wall, then recoil of the ball reaches the maximum, but, with less force in the ball, recoil diminishes. Applied to the violin thus: Development of greatest force in the strings demands employment of their entire length; therefore, shortening the strings operates to diminish force; therefore, when rigidity of the back exactly equals force in the entire length of strings, it follows that tones produced by shortening the strings cannot be equally augmented. It goes without saying that such violin as possesses powerful open tones, while marked weakness of tone follows successive shortening of the strings, is a violin of but insignificant tone-value. Thus maximum violin tone-power, and perfect smoothness of violin interior surfaces are inseparably linked together; and perfect smoothness of violin wood is an impossibility.

LECTURE XVIII.

GENTLEMEN OF THE VIOLIN STUDENT CLUB: The present hour marks the close of our course. Here are two pieces of wood possessing interest; this one is soft Michigan pine; the other is Michigan white cedar; and both are presented for the purpose of demonstrating the fact that oil may be applied upon even soft wood without being followed by penetration. In works upon the violin, we may often read that employment of oil as a protecting agent is hazardous because oil penetrates the wood. Again, we may read that permeation of the wood by Cremona varnish is the reason for tone values in the Cremona violin; also, that Cremona varnish is—excuse me Mr. Promoter—*was* an oil varnish. Because of the conflicting evidence in works on the violin, I could not reach a conclusion upon this important point without a test being made under my own observation.

It is apparent, without any test whatever, that penetration of oil must operate to diminish the rapidity with which the wooden spring returns to its point of rest; hence, penetration of oil into the sounding-board must operate to diminish violin tone-power. I reasoned thus: If oil can be applied to these two samples of soft wood without penetration, then oil can be applied in safety to any violin. To make such test reliable, I employed raw oil, because it dries more slowly than boiled oil; also, with raw oil, I mixed gum mastic, the slowest drying gum known to me. Nothing else was put in this mixture. The surface of the wood was made smooth, but, no filling was employed. Application of this mixture was effected with the rubbing pad, and in attenuated layers. Each layer was given time to dry before application of succeeding layers.

It is now more than ten years since these two pieces of soft wood were thus finished. With a knife, I scrape off the finish down to the wood for the purpose of showing that enough of this mixture was applied for protection. With this sharp-cutting blade, I now remove a thin shaving immediate-beneath the finish. As you observe, the wood is bright; and without any discoloration whatever. I attribute this fact to the manner of application. It is my observation that a layer of oil dries with a degree of rapidity proportionate to its thickness. Thus, the attenuated layer, possible to the rubbing pad, dries in much less time than the lightest layer possible to the brush. Applied in attenuated layers. it is my belief that less penetration of wood follows application of oil varnish by the rubbing process than the penetration of alcohol following application of spirit varnish by the brush. My reasons for preferring oil varnish upon the violin are thus:

1. Less penetration of wood.
2. Greater attenuation.
3. Greater elasticity.

Sadly I now take a parting shot at the post.

This innocent appearing thing is an ever ready butt for both the pen and the tongue. Although the post is at once an object of jeers, scoffs, railings and maledictions, yet its worth defies computation. Its adjustment and readjustment occupy idle moments of every violin user on earth. Although kept; "on the move," the patience of the post is endless. Having such anatomical parts as "la tete," (the head) and "la pied" (the foot) yet, the post stands equally well upon either end. In superlative fancy, the French surpass all other peoples by naming the post "l'aime" (the soul.)

Oh thou Post! Thy very name
Doth make us think thou art but tame;
Yet, thou art the very thing
Conferring title to the king.

Small thou art, of little space,
Nor worth appears upon thy face,
Yet, thou art a precious thought
By India's wealth 'twere never bo't.

To name thee "soul" doth harm to none,
'Tis thine by right of giving tone
To A and E which we do hold
Above the worth of Croesus' gold.

We are now well across the "dry district." As you remember, we were promised something for parched lips at this moment; and, if your minds are as my mind, we will celebrate this occasion by introducing our feast of the pass-over.

Have we not passed over impregnable difficulties?

Are we not also "dry?"

Verily, this dust along the violin's path is choking.

'Tis not best to give our entire time to dryness;

for without an occasional smile, life is scarcely worth the living. If real work is enjoyment of play, then, in all conscience, we are prepared for a moment of recreation. In amount of work, I know of no occupation surpassing the mastery of violin possibilities. Even the reading of it is tiresome. Although 400 years have been given to consideration of those possibilities, yet, this question remains new to each succeeding generation.

Will it ever remain new?

There's no doubt.

There's a bewitching power in the enchantment of violin tone surpassing the figures in arithmetic. The daily offering of wealth to the "king" surpasses all offerings to all other sorcerers combined. Although the germ theory of today covers the earth; although the germ hunter invades the very springs of life for his "cultures;" although he has segregated and named countless pathogenic and saprohytic micrococci, yet, in an unaccountable way, he has neglected to focus on the *violinicus universalis.* Considering the epidemic proclivities of this germ, such neglect is astounding. It is found all around the earth, and in all latitudes. It knows no prejudice for creeds, nor races, nor colors. Possibly, its neglect by the microscopist may be due to the fact that this germ is visible by sunlight, by moonlight, by starlight, self-luminous in darkness and never suffers eclipse. The *violinicus universalis* is ineradicable. In all climates, its presence is manifested by uniform symptoms, to-wit; intoxication and indifference to wealth. Nor wealth, nor rank, nor position whatever secures immunity from this irrepressible germ. The millionaire and the beggar jostle each other for seats beneath the artist's bow. Watch them at the moment when the first sweetly tender, soulfully intense tone reaches their hearing. From that moment, neither moves, neither breathes. Were eyes closed—they remain closed. Were lips parted—they remain parted. Both are drinking—drinking in the sweetest sound on earth.

Intoxicated?

Ask yourself.

Moreover, the more they drink, the more they want.

Music! Beautiful Music! All around the world, from hut to palace, thou art welcome. Thy language is understood by the whole world. As the sunshine, thy presence brings warmth. Thy power to touch human heart hath no parallel. Thy eloquence commands silence, and silence is willing. Thy subjects pass beyond mankind even unto the animal kingdom. Thy worship is boundless, and endless, even as the throbbing of hearts.

What is music?

For one thing, it is a demonstration ~~for~~ of the ease with which the grinning idiot may question the sage. Thinking perchance you may be a sage, and not seeing danger ahead, you begin with: "Music is something built from nothing tangible; a product of genius working in ether for æstheticism; an entity unknown but to hearing; matter without ponderosity; inconceivable material from intangible realms of thought and—— and——." As you glance at the broadening grin of yonder idiot, you avert your face in discomforture.

By the record, antiquity of music is great. The record carries the student back almost to the day when Adam, in Eden, became manager of opera.

Genesis iv:21. Speaking of the descendants of Cain: And his brother's name was Jubal. He was the father of all such as handle the harp and organ.

Thus we claim descent from Jubal. We are proud to know that our root handled the harp, for the harp is of strings.

[We do but glance sidewise upon the organ.] We do especially delight in such of Jubal's descendants as handle the strings. We are pleased with their soft voices and quiet ways. They live in a world by themselves and converse with the eyes and the strings. 'Tis true, they are distantly related to Cain; 'tis also true that "blood will tell;" yet, they never "murder music," neither do they "raise Cain."

[Can I ever be forgiven?]

Than the growth of music, there is nothing in history showing equal deliberation. 'Tis true that things of slower growth last the longer. Among other assets, Solomon possessed a band of four thousand trumpeters. From the best light obtainable, the scores interpreted by this magnificent band were limited to four tones. Developement of our major and minor scales required the time from Jubal to Palestrina in the 16th century of the Christian era. We owe much to Palestrina. Prior to Palestrina, that wonderful thing, called "harmony" did not exist, nor could it have been employed had it existed. In scale building, the genius of Palestrina made the modern orchestra a possibility. Today, loss of the symphony orchestra would put the world in mourning.

Six thousand years from Jubal!

Verily, as an example of slow growth, music permits no rival. But, development of music is not equally distributed. There are yet localities where the method of six-thousand-year Jubal remains in pristine purity. I know of nothing possessing greater interest than the moment when Jubal is brought face to face with an interpretation of music by the symphony orchestra of today.

You remember the recent presentation of the South Sea Islander's theater—its one-piece orchestra—the one hollow log drum—its one drum head—the one drum stick—the one son of Jubal who handled the stick—his inimitable look of ecstacy?

After mastering his *da capos*, and *dal segnos* with my very *dolcissimo* I asked him, "Would you please change the tonic?"

He answered never a word.

There was no need.

His soul-lighted eyes looked into my eyes, and from his eyes came signals older by thousands of years than the signals of Solomon. Within those illumined orbs I easily read, "'Tis all the key I know."

Our musical sense is the product of six-thousand-year culture. The musical sense of this son of Jubal is yet at the zero point. To him, the dreary monotone from his primitive instrument of percussion, (probably the organ, Gen. iv:21) is sufficient to translate him into the regions of sweet dreams; and, from his dreamland point of observation, the change to our major and minor scales, the change to the wide range of melody tones, the change to 24 keys, the change to harmony parts, the change to interpretation by a score of varying devices is to him but a change to incomprehensible noise.

Of such in heaven, to him 'twere hell.

To us, his "organ" is hell.

Yet, heaven cannot be denied him.

There is but one alternative—petition—petition that distances in heaven be great enough to accommodate all such as handle the harp and organ.

Thus all may remain in the union.

But yet, there's another matter for serious thought. Those very distances and planes for which we petition may cause trouble to ourselves. Thus: While here below, one trait of humanity is egotism; and, when seized of egotism, we are sure to attempt seizure of the highest seat. As egotism is blinding to introspection, therefore disappointment awaits some of us who think that we can handle the harp. The "*mæstro*" may feel certain of entering at the highest gate; but, do earthly standards compare with heavenly standards? That's the question. Even the bow of the "*mæstro*" may be too rough for angel ear. That we shall try the highest gate is possible. That some of us will be turned down is probable. The "*mæstro*" here may only enter a lower gate up there. That the violin will enter at the highest gate, we may feel assured, because, only the strings can accompany angel voice. But, we have assurances for hope. These assurances point to certain guide-boards; and, these guide-boards point the way. Thus, the "*mæstro*" may at least arrive at the highest gate; that he will enter therein depends upon precautions.

If the world owes much to Palestrina, it owes more to the church which, never for a moment, relaxes her fostering care for Beautiful Music.

The brave deserve to live.

The modern violin builder's 200-year fight for life has no parallel in history. Considering that only two human traits have been the cause for this prolonged struggle, we are astounded at the vast height. and the vast depth of those two traits. Specifically, those traits are:

Greed for profits.

Credulity of consumer.

Upon this occasion, greed for profits is much less in point than credulity of consumer; and, because of the fact that equal greed for profits is equally displayed in other lines of commerce; but, equal credulity is not found in any other consumer. No fact is more patent in violin history than the fact that human credulity is colossal. Since Stradivarius and Joseph Guarnerius pointed to the way, countless numbers of violins, equal in tone-value, have been built; but the builders have received no credit whatever.

The cause for such builders not receiving credit for violins of tone-value equalling the best Strad, or the best "Joseph" is a matter worthy of thought. For this cause, there are but three classes upon which responsibility may be laid, thus:

1. The violin promoter.
2. The violin consumer.
3. The violin builder.

The violin promoter interests himself only in the product of such builders as have acquired fame, and because otherwise, profits are insignificant. For large profits, the promoter depends upon consumers' sentiment alone; and, consumers' sentiment is as consumers' credulity; and, consumers' credulity is colossal. Next come the builders themselves—a procession—a funeral procession—apparently—yes, in reality.

Why for such mourning?

Mr. Violin Builder, because of friendliness for you, my scalpel is bent upon reaching the seat of your trouble. Don't wince. 'Tis for your good. Therefore, I diagnose the cause of your mourning to be that fatal malady called "imitation."

'Tis imitation that buried your hopes.

J. B. Vuillaume leads your procession. When the Strad violin came into demand, Vuillaume built Strad violins; sold them; sold them to experts in tone-values; proof enough that the Vuillaume product equalled the Strad product.

Fatal mistake!

Had those violins been honestly labeled, "J. B. Vuillaume, a Paris," then Paris today would be equally famous with Cremona.

From Vuillaume, the procession lengthens rapidly; consequently Strad violins are found in every village throughout Europe and North America, and, lately they are heard from in China.

When the credulous find themselves duped, credulity is followed by wrath; and, when wrathy, the dupe will not accept your imitation as a gift, even did its tone-value excel the best ever.

The brave deserve to live; and the day is rapidly breaking for those courageous violin builders daring to place their names upon labels. Even in high places, merit for the modern violin is now admitted, and the hand of the old-violin promoter is losing its nerve. From such accredited authority as Chas. Reade, London, comes the statement that the best Strad, stripped of its varnish, is worth today but $125. This is an acknowledgement that violins of equal, or even greater tone-value than the Strad are existing in abundance. Indeed, new violins are commanding prices undreamed of 200 years ago.

The fate of the Cremona "gusher" is a sad feature accompanying this change in sentiment. As the word "gusher" is applied to different objects, 'tis therefore necessary to state specifically that its employment in this connection does not indicate those mammoth geysers in Yellowstone Park, but does indicate the "Cremona gusher." There's a difference. The Yellowstone gusher displays action of deep water. The "Cremona gusher" displays action of shallow water. If anyone ever had an occasion to pray for deliverance from friends, 'tis Antonius Stradivarius. A man is a man—never more—sometimes less.

Soon the Cremona "gusher" will lose his occupation; and, for his fate, my pen sheds tears of inky blackness. With nothing upon which to expend his imagination, the Cremona "gusher" must die of appolexy. Sadly we turn away from the "gusher's" sickening exhibition of shallowness; and, our degree of nausea is exactly proportionate to our degree of esteem for the object of his "gush."

An account in detail of Cremona "gush" is too much; 'twould be an overdose inadmissable. Doubting the ability of my pen to give the Cremona "gusher" new pointers, yet, because of its desire, 'twill be permitted trial.

In such trial, 'tis but necessary to call up a single specimen of "gush." This specimen reads, "He, (Stradivarius) married the wealthy widow, Signora Capra, and thereafter pursued his chosen vocation from a purely artistic standpoint."

Certainly!

Ditto every poor devil of a fiddle maker when lifted above the pinching demands of quick-return fever. Although not intended by the "gusher," yet this statement virtually declares that Stradivarius knew the pinching demands of quick-return fever prior to his adoption by that benevolent widow.

My pen points to the fact that the "gusher" has entirely ignored the Signora Capra's equity in

Strad's glory.

A Joseph Guarnerius in jail!

And in jail for a paltry debt!

'Tis sad reading today in view of the fact that the modern violin builder is taking but little notice of $500 for a single violin; but, the neglect of the "gusher" for the jailer's daughter surpasses mere sadness. It does seem that even the Cremona "gusher" might understand that the "divinity which doth shape our ends," in lack of a benevolent widow, placed Joseph in jail for the purpose of giving him the services of the jailer's daughter in procuring the *finest material.*

As a "regular," I am prepared to prescribe for you poor fellows, thus; As a reliable, anti-febrile treatment for "quick return" fever, take a rich widow *a la* Stradivarius.

I sincerely hope that the Cremona "gusher" may yet retrieve lost opportunity to grant justice to the silent partners of Cremona's genii; but, for the sake of the living I sincerely pray that the "gusher" may grant rest to Stradivarius the honest, conscientious, ambitious, tireless, violin-loving, violin-playing, violin-making man —nothing more—1644—1737—equaled every day in the year One Thousand Nine hundred and Five.

'Tis said the superior violin is a product of genius. The Hon. W. E. Gladstone said the evolution of the violin cost more thought than evolution of the steam engine.

In all human activities, I know of none possessing equal difficulty in commanding superiority of product with the art of violin making. I know of no route to superiority of violin production other than experience combined with intense application. To me, the superior violin appears as a product of superior mechanical skill combined with superior musical sense and intense application, all directed upon superior material—nothing more—nothing less.

Than the art of violin making, I know of no human activity possessing equal temptation for fraud. Within the violin lies much of the work upon which value depends; and, because much of its interior is hidden from view, fraud steps in. None can look only upon the exterior of a violin and determine that fraud does not sit within; yet, every purchaser believes that the violin always improves with age and use. 'Tis the universal belief that the violin always improves with age and use. The universal belief in this delusion makes my heart ache. Such belief is an *ignis fatuous* daily leading its victims into the Slough of Despond; and, the procession thereto is a multitude. All around the world, in daily increasing volume, the tenderest feelings of human hearts are poured out at the feet of Beautiful Music. That fraud is permitted to thrive upon such tender feelings makes the devil wild with joy.

You who have carefully read these pages are prepared to comprehend the difficulties surrounding the path of the conscientious violin maker. You are prepared for the fact that the most skillful workman, try as he may, occasionally must meet more or less of defeat. From history, you learn that, even to the superior workman, appreciation is slow in coming. In the presence of this fact, and, in the presence of pinching want, and, from my own view-point, that violin maker who resolutely turns his back upon temptation to defraud is a person cast in heroic mold.

Of such stuff are heroes made.

As you remember the past, as you honor justice, and, as you love music, wherever and whenever you find such hero, you will hasten to place the crown of merit upon his brow while he yet lives; and, in the bestowal of honors, as you honor fair dealing, you will not forget the equity due his silent partner. Throughout the gloom of waiting days her voice has been his cheer. Grant her honors.

Beautiful Music! Thou canst save
When others fail. To me thou gave
The pow'r, th' will, th' tho't to move
From out th' stubborn sinner's groove.
Beautiful Music! Thou art th' leav'n
Op'ning wide the door to heav'n.
Love I thee? E'n to th' end,
With thee to heav'n, my way I wend.

Thou, O Music! At thy feet, my tribute lies.

APPENDIX.

In every life, explanations for technical terms are desirable at one period or another; and, such period may come during youth, or it may be delayed until advanced age. I find it impossible to write at length upon violin tone-peculiarities without employment of some technical terms; and, remembering the period when technical language was confusing to myself, and remembering my pleasure accompaning elucidation of such language, and, remembering my desire that all readers receive reward for the punishment incidental to wading through the dry details on preceeding pages, therefore do I willingly append an explanation for some of the more confusing terms necessarily employed herein. To those readers not interested in such explanations, 'tis unnecessary to suggest the waste of time in reading these closing pages.

ALT: All tones in the first octave above the staff.

ALTISSIMO: All tones above *alt.*

METEORIC CONDITIONS: Are such conditions of the air as barometic pressure, temperature, humidity, (water vapor,) winds, and clouds. As all of these items, singly, or combined, operate to diminish or augment the distance traveled by sound-waves, therefor, such items become matters of interest to the student of violin tone.

BAROMETRIC PRESSURE: Refers to weight of the air as indicated by action of mercury in the tube of the barometer. As the mercury falls, weight of air is lighter. As the mercury rises, weight of air is heavier. Such variations in the weight of air are frequent, especially in our summer months, and, they may be so great as to cause great difference in the distance traveled by any sound from any source whatever. Strangely, the violin, of all musical devices, is the most sensitive to atmospheric conditions as is manifested by feebleness of tone-intensity upon dates when heat and water vapor are in excess. Under such conditions, string-tone values suffer unavoidable depreciation, no matter who the maker, nor what the quality of material.

THE NIMBUS CLOUD: Overspreading all of the sky, operates to augment distance traveled by sound-waves.

TEMPERATURE: May be either so high, or low as to greatly diminish the distance traveled by sound-waves.

WINDS: Operate to diminish the distance traveled by sound-waves in opposition to the current, and, to augment the distance traveled with the current.

HOUR OF DAY: Is of importance in the record for the distance traveled by sound-waves, because during the midday hours, sound is propagated with greatest difficulty upon any given day.

SOUND-REFLECTING AGENTS: Are such objects as buildings, hills, timber, operating to augment distance traveled by violin tone in the long-distance out-of-doors test for intensity.

Thus, the record of any violin for "carrying power" possesses but little interest unless accompanied by the readings of the barometer, hygrometer, thermometer, together with the direction and velocity of winds, degree of cloudiness, hour of day, and, the presence or absence of sound-reflecting agents. With such record thus complete, a violin may be safely guaranteed to repeat its performance under similar meteoric conditions. It is important to the violin player to know the distance to which the tone of his violin travels with ease. Thus, the player may avoid overexertion with the bow, as such overexertion always produces a disagreeable effect upon the musically cultivated ear.

OSCILLATION, AMPLITUDE of OSCILLATION, VIBRATION, both NORMAL and TANGENTIAL, NODES, VENTRAL SEGMENTS, HARMONIC OVERTONES, and DISSONANT OVERTONES: Are explained thus: Confining this matter to facts of practical value to violin tone, I employ these two strings as a means for assistance in making definitions clear to the understanding of every reader. These strings are of equal length, equal diameter, and, of identical material, but, are unequal in structural perfection. String A is apparently perfect, String B is apparently imperfect. The action of these strings will explain, not only some technical terms applied to vibrating bodies, but, will explain the necessity for employing wood of structural perfection to produce the violin of best, or highest tone-values; also explain why the violin maker, scientific, or otherwise, must meet defeat when working with wood of structural imperfections.