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The Violin Makers Journal

THE OFFICIAL PUBLICATION OF
THE VIOLIN MAKERS ASSOCIATION OF BRITISH COLUMBIA

Antonio Stradivari (1644-1737)

(Old Wood Cut ..... Courtesy of "Popular Mechancs")

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The Violin Makers Journal

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EDITORIAL PAGE OF *The Violin Makers Journal*

DON WHITE, EDITOR-MANAGER

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GUEST EDITORIAL

VIOLIN MAKING IN SWEDEN

by Gunnar Sanborn
translated by Erika White

Sweden is one of the small countries of the world with a population of around 7 million people.

A great deal of Northern Sweden consists of large areas which are not suitable for habitation, partly because of the mountainous terrain and partly because of the cold climate, so it is very sparsely populated except along the Baltic coast.

It is quite remarkable that so small a country has so many violin makers. To understand the reason for this one must know something of the musical background; of the folk music on which violin music is based. This folk music has deep roots even in our days; and in spite of an unheard of outbreak of so-called modern music is still fondly cherished by many outstanding musicians. The Swedish folk music, and also the folk music of other Northerners, is based on the melodies, rhythms and harmonies which originate for the most part in the classical music of South Germany. There are some 10,000 Swedish folk songs which have been recorded and treasured, many of them real jewels. The performance and enjoyment of this music, as of any other music, requires instruments and these are supplied to a large extent by amateur violin makers.

It is estimated that there are about 2,000 such makers. About 400 of them are organized into the "Swedish Violin Makers' Association." This organization started in 1928 on the initiative of Ernst Granhammar, who was an enthusiastic violin-maker and also a performer of folk music. He died in 1946, but one of the members who was with him from the start, J. A. Carlo, an engineer by profession, is now chairman of the organization and also Editor of the paper "Slojd och Ton."

The association carries on wholly by private initiative. When it was formed Ernst Granhammar tried to get a subsidy from the government to help finance it. But that was met by the authorities with a cold "An organization that is worthwhile can get along without help." For a while the association received occasional assistance but is now self-supporting. Now it must "prove its own worth" by carrying on without help.

Within the organization are a number of local clubs in the Middle and Northern parts of the country. At present there are six of them and they carry on the work in their own respective communities. These clubs have done a great deal to raise the standard of Swedish violin-making. The members meet once a month during the winter and discuss violin-making, examine instruments they have made, and play them. Those who have watched the development of violin-making in the clubs since their inception twelve years ago, can readily testify that it is heading in the right direction.

Materials used for the instruments are usually imported from Southern Germany. Swedish lumber can be obtained but nothing especially cut for violin making. One seldom finds even-grained spruce and the Swedish Maple is very hard, and difficult to work with.

The greatest problem for most amateurs is to find a good place to work. They must work in the home, often in the kitchen. The little wood-shavings left by the work are not very popular with the housewife.

I heard of one clever and well-known maker, now dead, who was obliged to work in his bedroom. He declared once that violin making was most enjoyable even if most of the time was spent getting out his materials and tools which were under the bed, in boxes, in cupboards and on shelves; and afterwards, in putting them back and tidying everything to his wife's satisfaction! Many people have a better place for their hobby and in some cases two or more makers club together and hire a special room somewhere.

In this country there are very few professional makers, only about ten, and some of these are foreigners. Between these professionals and the amateur there is no cooperation to speak of, although sometimes they do get together. Most of the professionals are found in the three large cities, Stockholm, Gotebord and Malmo.

A contributing factor to the great interest in violin-making in Sweden is the long winter evenings. For seven or eight months the long dark evenings encourage indoor activity, especially in the northern parts of the country.

Then it is good to have a hobby that combines usefulness with pleasure, which gives one so much fun in the making of something which will also provide enjoyment in the playing, for a long time to come.

"Munificent donation by Gioachino Pasqualini to the Accademia Nazionale di Santa Cecelia."

This headline has announced in the leading newspapers of Italy and other European countries the news that Prof. Pasqualini, Rome, Italy, has donated his unique collection of musical instruments to the Academy of St. Cecilia in Rome.

This collection of genuine, antique instruments is a fine illustration of the historic development of musical instruments to their present form. It includes instruments of all families, bowed, keyboard and percussion, the forerunners of our modern instruments, of all forms and from all countries, as well as more than five hundred ancient bridges and bows.

In the next issue of the Journal we will have more to say about Prof. Pasqualini and his generous gift, the news of which has reached us too late for proper coverage in this issue.

Communication from Mr. Hoing

Dear Don:

In the interest of accuracy, would you please print further details of the news item given you by your President and published on page 36, col. 2, of the September-October issue of the violin Makers Journal.

The competition mentioned was NOT a recent one and was in fact held on March 22nd, 1935; PLEASE NOTE 1935!

I was still an amateur maker then and, according to players who use them, my instruments have greatly improved in nearly thirty years! Nevertheless, Dr. Whitfield who owned one of the Strads in the competition, said that he liked the tone of my instrument far better than that of his Strad.

I think you will agree that the publication of the item WITHOUT the date could be misconstrued and I hope you will not mind my drawing your attention to it being a trifle out of date! Yet you mention that it is a "new clipping" !!!

Clifford A. Hoing,
137 West Wycombe Road,
High Wycombe, Bucks.,
England.

Supplementary Information about The Microtone System

(continued from Nov. -Dec., 1962 issue)

It has been stated (also here in the Journal) that there are no vibrations in the air in the f-hole openings for other notes than that of the air tone. I have showed (also in the Journal) that this statement is wrong. By means of a little microphone or our simple stethoscope placed in the f-hole openings we can hear directly that the sound emitted from the f-holes is not less than the sound emitted from the plates. But how can it be explained that e.g. a little whisp from a feather placed in the f-hole opening, lighted up, and looked on in a microscope (described by Dr. Saunders) by the airtone (and as a whole only for that note) can be moved so vigorously that it can be seen? Well, a sound of a certain loudness can be produced (to take the extremes) either by a great emitting surface and very small amplitudes - or by a little emitting surface and correspondingly great amplitudes. A bow instrument represents the first case, a wind instrument the second one. Only for the pitch of the airtone a violin behaves to some extent as a wind instrument with great amplitudes from the small emitting surfaces of the f-hole openings. For all other notes the amplitudes of the vibrations in the f-hole openings are of a similar diminutive size as for the vibrating plates - and cannot move a little whisp vigorously enough to be seen.

Let me finish this rather theoretical section of my article by giving one characteristic more for a violin tuned to the microtone system. Such a violin will have a very long "after ring". Especially when a loose string (no matter which) is plucked, the "after ring" is extremely long - indicating the lowest possible damping.

In J.A.S.A. Vol. 17, No. 3, p. 183, Dr. Saunders mentions "beats" in a violin. If "beats" in this connection mean the phenomenon that the loudness of the emitted sound is pulsating, we can also notice the character of the "beats" when a loose string is plucked, and use this character in judging the quality of the violin.

If a violin has full accordance in microtones there seems to be no "beats" at all - only a very long even "after ring". If the violin has approximate accordance - such as in some of the best old violins - "beats" will occur, but their frequency will be very slow (intervals of several seconds). The "after ring" will still be very long. With less accordance of microtones the frequency of the "beats" will be more rapid, and the "after ring" shorter. With no accordance at all perhaps we cannot perceive any "beats", but the "after ring" is very short, indicating high damping.

The following (and last) section of this article will have a more practical aim. It is partly what I have written to Mr. Nicholas Ventimiglia, Italy, but I think it may be of common interest, not least because I am also here treating the building of a new violin from the microtone system.

I have been asked why I am not using electric equipment by determining the microtone pitch. My answer is that I am able to do it without. When tuning a violin to the microtone system, we have to take the pitch thousands of times, and if every time I should use electric equipment, it would delay my work considerably. In fact I am able to work out the plate thicknesses by means of the microtone system much faster than I would be able to do it by means of a gauging calliper following a given thickness pattern.

By determining the microtone pitch your (Mr. Nicholas) electric bell arrangement (LUTHERIE No. 13) giving a continuous tapping tone may be very useful in the start, but when we have trained our ear, and worked intensely with the system for some years, we will find it most convenient to use only simple means: a gentle tap with a nail, a bit electric wire (you can also use it as a diminutive drumstick), a bit of wood, etc., or a gentle stroke with a finger tip. Even the sound from the scraper over the wood can be guiding. But it is very important to tap gently as it is the sound from just the little area we are testing, we have to perceive, and not the "tap tone" from the whole vibrating plate. And often we have to damp the wood surrounding the area we are testing with our finger tips to prevent the vibrations to run too far and give us the sound from a greater area than intended.

The first condition of building a violin from the microtone system will be, of course, that the maker is able to determine the pitch of the microtones. I have tested hundreds of violins for their microtones, and built or rebuilt more than ten instruments from the system, all of them sounding just as any fine violinist think a violin has to sound. In several cases fine professional violinists have visited me and showed me their own old expensive violins of which they were very proud. After having tried one of

my violins they were less proud of their own, and some weeks later they have returned - unhappy - because they could not stay to play their own violin any more. Besides the violins I have already built, I have been ordered 12 new violins and several rebuildings.

To say I have no difficulty by determining the microtone pitch, would not be correct, as I have to concentrate very much on the task, but I can do it. I can say that the ability to hear the microtone pitch depends on the ear, and the training of it. I have examined a lot of people in that respect. I have never met with a single fine violinist who was not able to hear the microtone pitch, when first he was told, what he had to listen for. Some of them were able to tell the exact pitch, some others were only able to tell the relative pitch, that is, to say which of two microtones was the highest, but even this is all what a violin maker needs. On the other hand not so many of the violin makers I have examined were able to tell the pitch, and to some of them the microtone was only a weak sound without sense. Regarding this last category, I am afraid you are right: to him the tuning by ear will present enormous difficulty, and perhaps he will never succeed.

But also a lot of the old Italian makers must have had the same difficulties. By testing the old Italian violins we will notice that only relative few of the old masters - Stradivari and Guarneri (del Gesu) e. g. - must have had a very fine and highly developed ear, which enabled them to master the microtone tuning to full extent. A lot of them have only mastered the system partly, and some of them not at all. That their imperfect violins are paid for with high prices is unwarranted in a way and only a consequence of the value of the really fine Italian violins. Of course, often they will have a pleasant outer appearance, and they can be tuned to sound beautifully. I have tuned such an old imperfect violin, a Petrus Joannes Mantegatia (1770). This violin had practically no accordance in microtones, and from its interior I could see that it was not some or other maker who had spoiled the accordance by unskilled repair. There had never been any such accordance. The violin sounded not much better than an acceptable factory violin, but after the tuning to so near full accordance in microtones as the wood dimensions allowed me the violin sounded as a real old master violin. Of course, we must be sure we can master the system, if we will try to alter the thickness dimensions in such a violin - it is too expensive for experiments.

But what can we try to invent to facilitate the tuning task for the maker to whom it is difficult to determine the microtone pitch? A sensitive microphone can take up the sound from a microtone, and if the microphone is combined with an amplifier and a loud-speaker, the weak sound can be amplified considerably. This in itself may be a help to someone. Furthermore an electric tone-generator can be helpful. If the amplified sound from the loudspeaker and the sound from the tone-generator is tuned to the same loudness, it will be more easy to compare the tone pitches and to find the microtone pitch on the generator, where the frequency can be read. Instead of a tone generator we can also use a monochord, but a monochord has some overtones, and will therefore be more difficult to compare with than the tone generator.

But it is still the ear that must compare and decide the pitch. For those who can better use their eyes than their ears, I have thought of an arrangement. If a set of resonators with own-frequences within the range of the topical frequencies is placed in front of the loud-speaker the amplified sound from the microtone will be loud enough to set just the resonator with the same own-frequency (or resonators, for a microtone is not a pure tone) into vibrations which in turn could cause a current to light up a little bulb, and the frequency (written by the side of the bulb) can be read directly. I have not tried such an arrangement, and perhaps the sound from the microtone is too brief (I think 2 or 3 frequencies, as Dr. Saunders has stated that the tapping on a violin back produces about 5 frequencies) to cause the resonator to vibrate, but here your electric bell arrangement giving a continuous tapping tone may be useful. I have no idea how expensive such an arrangement will be, but just cheap I don't think it is, and for my own use I think I am doing without.

You write concerning the microtone system: "The idea is very inviting, and if we can prove statistically that it works, then we are on our way to a perfect violin." Well, I think we can do it, prove it just statistically. Perhaps now and then we can build a good or even nearly perfect violin by good luck from nearly every system, but if a system is not based on a physical reality we cannot build violin after violin from it sounding perfectly without exceptions. Some ten violins are not enough to be taken just as a proof, but as a very strong indication. But also a few other violin makers have built violins from the system with the same result. Furthermore I can test a violin - new or old - for its microtones, and from this test (without having played the violin or heard it) I can say nearly exactly how the tone quality of the violin is, and on the other hand, I can play a violin or hear it played and from this (without having tested its microtones) I can say approximately how its microtones are - so closely are the microtones and the tone quality of a violin connected.

I have also had the opportunity to follow how much the accordance or not accordance in microtones mattered within the same violin. For a violinist I tuned his violin to the microtone system, but as he was very eager to get his violin back, I glued the top on although I was not quite sure the interior wood surfaces of the plates were hardened thoroughly after the tuning process. Well, the violin

sounded perfectly, and the violinist was happy. A fortnight after the violinist returned - less happy. The tone was no longer flawless, even if still good. I tested the violin for its microtones. The microtone pitch in some small areas had raised a little, due to the hardening of the wood. In the following time I tested the violin now and then. The microtone pitch in the said areas was still changing, and the tone quality was not constant. After a fortnight more, the hardening process was fulfilled, and the tone quality did not change any more, but the accordance in microtones was scarcely tolerable, and the tone quality was not better than for an ordinary good violin. Once more I removed the top and tuned the plates to full accordance in microtones, repeating the attunement until the hardening process was finished, and the microtone pitch constant. Then - after a month - I glued the top on again. The violin sounded perfectly again, and this time the tone quality remained constant.

From all this you will understand that I am fully convinced that the microtone system works, and that these very strong indications to me are as good as a proof. But as I am taking little or nothing by authority myself, I am not expecting that others should take my experience and my conviction as a proof. But I think I can outline an experiment, you and other interested makers or physicists can perform.

Take a violin - just a cheap one, as perhaps the violin will not be beautiful in appearance after the experiment. Remove the plates from the ribs. Work out the top in the way desired (you can use the method described in my article "How to rebuild a violin from the microtone system"), and tune also the ribs to the top and glue the top to the ribs again. The original back you shall not use (this can be tuned after the experiment has been finished, and you can get a well sounding violin out of it, if you should like), but work out another back of plain maple (the most convenient for this purpose). Work out the back a little too thick, that is, the microtones of the back should all over be a little higher than for corresponding areas in the top. Glue the back to the ribs. Tune the sound post to the same microtone (or rather an octave above) as for the spot of the top where it should be placed inside. Place the sound post correctly, and string up the violin. The tone quality of the violin will not be good. Now (with the violin strung up) tune the back by scraping it on the outside all over to the same microtones as for corresponding areas of the top. Play the violin. It will sound beautifully. Let the violin remain some days, and control the microtones and the tone quality. The hardening process of the back will start. The microtone pitch will change, and so will also the tone quality. After a week you can tune the back once more, and once more the violin will play beautifully. You can repeat the attunement several times, say over a month, and the alterations will be still less. A thorough hardening of a new back will take several years, but experiment must have an end. Therefore, after a month tune the back all over a little too low to the top. Play the violin. It will sound not worst, but the fully clarified tone and the "flashes", which originates from the full resonance, it will not have. Now varnish the back - only with a colourless quickly drying varnish. When the varnish is dry, you can test the microtones once more; they will have raised again all over the back, but most on the thinner areas. If the pitch of the microtones in the back has raised above those of the top (which is most likely) the tone will be no good. You can tune the back once more by polishing the varnish down, and once more the violin will sound beautifully, but it will not last, as the hardening process of wood and varnish is still not fulfilled.

If you are not convinced by this experiment, you can repeat it by making another back, and every time you have tuned the back to full accordance in microtones you will get the same tonal result. I think this should be accepted as a proof.

Of course, commonly a violin shall not be tuned from the outside, even if I have the impression that some second-rate (but good) Italian makers have done this to judge from scrape-marks on the outside of their violins. We should take the trouble to tune it from the inside, and keep the outside beautiful.

And now - as promised - something on what especially to take care of when building a new violin from the microtone system. You will have understood that what especially troubles when building a new violin is the hardening of the material (wood, glue, and varnish). Especially the hardening of the maple takes a long time (several years), while the hardening of the spruce is much faster and to a much less extent. (Concerning this, I can report a little experiment. In 1945 I made two "sound staffs", one of maple, and one of spruce, dimensions 36ox18x18 mm. When holding them in a distance of 2 to 7 from

one of the ends (that is, the piece when tapped will give the second partial, the octave) the piece of maple sounded with the note a' = 44o cyc/sec., while the piece of spruce sounded e'' (the fifth above). I kept these wood pieces to see how they would behave in the course of time. Today the spruce is still sounding e'', but the maple - due to the hardening process - has raised in pitch to h' (your b'). Also the hardening of the varnish will commonly take years.

To tune a violin finally in the white will make no sense, as the varnish and the hardening of this will alter

the pitch of the microtones. Wood and varnish (and glue) together thoroughly hardened make up the material we have to tune finally. If we tune the violin "finally" in the white, and then apply the varnish, we will notice that after the hardening of the varnish the relative thin areas will have raised a lot more in microtone pitch than the thicker areas, and that means e.g. for the central part of the violin, that the E-string-side of the top (which is thinner than the corresponding area of the back) will have higher microtone pitch than the back, while the G-string-side of the top will be lower in microtone pitch than the corresponding area of the back, because the bass bar and the top here together form the thickness. Therefore when building a new violin, we have to leave the central part of the back a little too thick, and the bass bar a little too deep all over. This - together with other irregularities - we have to correct after the wood and the varnish has been thoroughly hardened, that is, we have to remove the top of the finished violin and tune the violin finally from the outside.

Due to the long hardening process of the maple, I am not building one violin continuously from start to finish, but I am building several violins parallel, and I start to work out a series of backs, which can be laid aside to harden while I am doing all the other work on the violins. The outside of the backs I work fully out (except the purfling, and the rounding of the edge), but the inside I only work out roughly and a little too thick. The purfling I always lay in after the plates have been glued to the ribs. So did also the old masters, and this is tonally the best. No matter how old and seemingly dry a piece of wood is, when it is worked out as a violin plate, the new wood surfaces will try out, and the plate will contract. If we have tied up the edge by a stiff purfling, before the new wood surfaces are worked out, the plate cannot contract in a free and natural manner, but some unwanted stress will occur.

When Stradivari died, he left not only a lot of violins (more or less finished - perhaps he had intended to adjust their attunement later on), but also a lot of loose violin plates. Much has been guessed on these plates, and it is commonly suggested that the plates were someones, he had condemned for some or other reason. I think that if he had condemned them, he would not have kept them, and I think it more likely that the plates were laid aside to harden until he was able to tune them.

The economy of the old masters didn't allow many of them (presumably none) to have such a store of violins and violin plates for future adjustments and future sale, but nor has anyone else been able to yield a similar great production of a homogeneous high standard. Perhaps you think that Vuillaume had a still greater production than Stradivari, and that is true, but his tonal standard was much below that of Stradivari. Vuillaume doesn't seem to have known the microtone system. At any rate none of the Vuillaume violins I have tested were tuned to full resonance. He seems to have used another system, used by most of the better French makers: to leave the back all over a little too thin in relation to the top. Such a violin will sound very well, but as said, the fully clarified tone, and the "flashes" will not appear. But such a violin can be said to have the advantage to improve in tone as long as the back is hardening more than the top - this bringing the microtones of the two plates nearer to each other, nearer to the full resonance, and perhaps now and then a violin will end its hardening process with full resonance. A violinist playing such a violin that improves in time will think he himself has played the violin better.

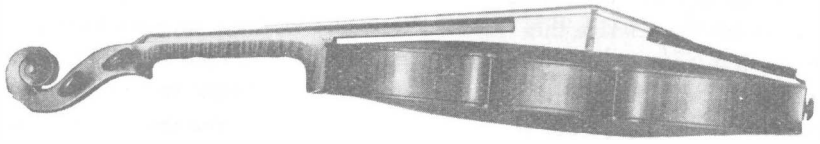
A new violin not hardened thoroughly before it is taken into use will change its tone quality for the first years of its being. If the back originally has been worked out a little too thin in relation to the top, the hardening process of the back will cause a still better tone production, and the violinist will say the violin has "broken in". If the back originally has proper thicknesses in relation to the top, the violin will sound beautifully in the start, but the hardening of the back will raise its microtones above those of the top, and the violin will play still worse. The violinist will say the violin has lost its tone, and blame the violin-maker who must have worked out the plates too thin, since the violin has already been "played dead". If the back originally is too thick in relation to the top, the violin cannot play - neither in the start, nor later on. It is the changes in microtones that accounts for the changes in tone quality. And the playing in itself independent of the microtones? Well, to some extent, a violin can really be played better, but not so much as is commonly supposed.

One thing more I have to mention: the preliminary treatment of the wood with some or other "filler" before varnishing. The material to use for that purpose must have the property to be able to harden to a material with constant elastic properties - if not, we cannot tune the plates finally. Linseed oil I don't appreciate very much as a filler. All experience seems to indicate that linseed oil is not stable in its elastic properties in time, and if this is correct I dare say that the old Italian masters have not used it - or none of their violins would have kept their tuning. At any rate they have not used it in pure state, but perhaps connected with the use of chalk or lime which seems to have a stabilizing effect on the dried oil.

But the treatment of the wood I think I will leave to - and to be connected with - another article on varnish.

Kristian Skou

The End



Living makers AND their instruments

W. E. SLABY AND THE EXPERIMENTAL APPROACH TO VIOLIN MAKING

by Victor Angelescu

A regular reader of the Violin Makers Journal cannot fail to notice how often the name of W. E. Slaby (pronounced SLAB-bee) has been cropping up lately in its columns, either to identify himself as the author of articles written for the Journal or in comments on his work by such men as Carmen White or Joseph Michelman. The increasing frequency with which his name is encountered in the conversation of violin makers is due not only to the excellent workmanship which is evidenced in his instruments, but also to his scientific and experimental approach to violin making. Slaby, who lives and makes his violins in Royal Oak, Michigan, has a passion for finding out the "why" of things in violin making and this is probably the major reason why his influence on other makers is far greater than might be indicated by the comparatively small number of instruments he has so far produced. In this article, with its emphasis on Slaby's biographical background, an attempt will be made to probe more deeply into the man and to determine the philosophy which guides him in his thinking about violins.

William Edward Slaby, who is generally called "Bill" by his friends, was born on March 26, 1916, in Traverse City, Michigan. His father, one of five brothers, was a carriage and sleigh maker who worked in the family shop. Later the Slaby family switched from carriages to the making of automobile bodies. Bill's father was a good workman in both wood and metal but it was his great uncle who particularly impressed the lad with his workmanship, and Bill considers this uncle to be one of the finest craftsmen he ever knew. From the time he was five years old, young Bill worked off and on in the family shop where he became adept at woodworking, varnishing, and the performance of other tasks. With this background and experience, then, it is not at all surprising that Slaby should be an excellent craftsman himself. An extremely high standard of workmanship is a prime characteristic of his instruments.

Slaby doesn't remember exactly when he first became interested in violins but one of his earliest recollections centers around the theatre performance of a string base player. Bill thinks, however, that the fact the theatre burned down the same night he attended the performance may have some bearing on the intensity of his recollection. As a child he also recalls witnessing the performance of a violinist and being entranced by the fascinating whiteness of the bow hair. And thus it was that at the age of eight Bill decided to make his first violin -- a grand production complete with four rubber-band strings.

It is a source of regret to Slaby that he never really became a good performer on the instrument he loves so much. Bill's maternal grandfather, who could play seven instruments, was a competent performer on the violin and cornet, and Bill wishes that he could have learned to play the violin as well as he. Slaby did study violin for one year in the public schools of Traverse City and he also had a year and a half of private lessons. He feels that he might have become a good player had he been given proper guidance, but this was apparently lacking. Yet despite this deficiency, Slaby does feel that he is musical. He likes to listen to concert performances on the violin, and, in addition to classical music, he has a special love for Dixieland jazz. Slaby's interest in music is shared by his entire family. His twelve year old daughter Carolyn, who plays one of her father's violins as well as piano, is a talented performer and composer in her own right. In the past year she won a state award for a piano suite she composed, and she attended an all-state session at The National Music Camp at Interlochen, Michigan. A fourteen year old son, Billy, plays the piano and drums, and has won a scholarship to Interlochen for his drumming ability. Judging from the high quality of Billy's model railroad work, he has apparently inherited a great deal of his father's mechanical ability. Slaby's vivacious wife, Beverly, also

studied the piano but Bill teasingly says that she has no sense of tone, and that one of his first misgivings after marriage was his discovery that they couldn't sing duets together. But this is one statement by Slaby that should be taken with a certain degree of skepticism. Whatever the true status of Mrs. Slaby's tonal sense, however, there can be no doubt of her love for music. She shares her husband's enthusiasm for violin making and even has a theoretical knowledge of violins which would rival that possessed by many makers.

The making of violins is for many readers of the Journal a hobby or spare time activity. So is it also with Bill Slaby who has accomplished much in other fields of endeavor. After he graduated from high school in Traverse City, he came to Detroit where he attended Wayne State University while also working for the Michigan Mutual Liability Company. He received a Bachelor of Arts degree in Industrial Education in 1943 and a Master of Arts degree in 1952. Two months after his graduation in 1943 he went into the armed forces, was trained as a communications officer, and eventually became an adjutant in a communications squadron. After his discharge in August of 1946 he was offered his previous position at Michigan Mutual but three months later he was called to Wayne State University as assistant registrar, and he has been there ever since. Recently he has been promoted to the rank of associate registrar, which, when one considers the University's continually growing body of 20,000 students, is a position of considerable responsibility.

It would seem that violin making was always at the back of Bill Slaby's mind, for at the age of eighteen he collected some violin wood for possible future use. But his serious interest in the craft began a few years ago when he wanted to purchase a ukelele for $30. Mrs. Slaby objected and thought that the money could be put to better use. This, says Bill, was a serious tactical error for his wife to make, for he then decided to construct his own ukelele and as a result has since spent most of his spare time in his basement workshop. He has made two other ukeleles -- a tenor and a baritone -- in addition to the first one, and has also completed five violins. He is also in the process of completing two Tertis model violas which will not be varnished until next summer because he is using linseed oil as a pre-varnishing treatment and wishes to make certain that the oil has been thoroughly exposed to the heat of the sun. The problems which Slaby has encountered in making and varnishing his instruments have been fully discussed in his open letter to Carmen White and Joseph Michelman (see VMJ, Dec.-Jan., 1962, pp. 6-9) and will therefore not be repeated here. Suffice it to say, however, that violins number four and five received scores of 95 for both varnish and workmanship in the 1961 contest sponsored by the Arizona Violin Makers Association, and this placed Slaby in second place for composite scores. Moreover, his recent work on the Tertis model violas exhibits such a high degree of craftsmanship that Josef Deulin, who is an excellent maker himself, has facetiously advised Bill to make a deliberate slip of the knife or other mistake occasionally, lest people begin to think that his instruments are machine made.

Bill Slaby's approach to violin making is frankly experimental; he keeps an open mind and is willing to try new methods and procedures if he feels they might have validity. At the present time he is using a modified Carmen White method for the tuning of plates and eventually he would also like to make a violin according to the method of Justin Gilbert, so that results can be compared. Slaby has a healthy respect for the amateur maker and thinks that the amateur has the best opportunity for advancing the art of violin making. Since he is not dependent upon violins for his livelihood, the amateur shows more willingness to try out new approaches and is not afraid to be led up blind alleys. And if a dedicated amateur keeps thorough records of his experiments and procedures, he will make it easier for succeeding generations to evaluate his work and to explain the reasons why the tone of one of his violins, for instance, is better than the tone of another. How much easier it would be for the modern maker if the old masters had kept records of such things as varnish formulas and their reasons for using certain construction techniques. It is true that some logical deductions about the old masters can be made from direct examination of their instruments, but this can only be carried up to a certain point. Slaby himself keeps detailed records of his violins and would like to encourage other makers to do likewise. One practice which he suggests, and which he intends to follow when selling his own instruments in the future, is the issuance of a certificate giving all the pertinent information about a violin which might possibly explain its particular tonal qualities. This certificate would be intended to travel with the violin each time it had a new owner. Since certificates of this kind could easily become lost, however, another possible solution to the problem might be for a violin maker to deposit his records in the archives of a public library of some similar institution. The Detroit Public Library, for instance, is famed for its Burton Historical Collection which is a repository for information and documents pertaining to the history of Detroit and Michigan. If the records and notebooks of a maker were on file here (or perhaps microfilmed) then historians of the violin could refer to this information in future years. Bill Slaby has not definitely made up his mind about the disposal of his own records after death, but these are possible ideas which have occurred to him and he wonders what other makers might think about them.

Why does the making of violins appeal to so many and to such a wide variety of people? Slaby has wondered a great deal about this and thinks that probably one reason is that all makers wish to discover the "secret" of the old masters. Violin making, of course, certainly serves a worthwhile purpose in trying to put good instruments into the hands of the masses. But Slaby believes that in putting his best efforts into an instrument, the violin maker is subconsciously seeking a kind of immortality. Bill Slaby is too modest to suggest that he will achieve immortality through his own instruments. This much can be said, however; he makes excellent violins and very likely will make many more. Keep an eye on this man. On the basis of past performance, his impact on the future of violin making will be considerable.

THE SLABY METHOD FOR MAKING A VIOLIN

by Victor Angelescu

Most violin makers have their own methods and procedures for making a fiddle, procedures which they may have learned from actual experience. Yet it is always of interest to them to hear of other techniques of which they previously may not have been aware. This article will be devoted to a description of some of the techniques used by William E. Slaby of Royal Oak, Michigan.

Slaby begins his violins by dressing down the flat ribs and linings to the precise thickness he wants them to be. For this he uses a sanding machine which he developed and which he described fully in a previous issue of the Journal ("Sanding Machine for Ribs, Linings, and Purfling", VMJ, Sept.-Oct., 1959, pp. 10-12). This sander assures that the ribs will be uniform and with it can he work accurately to within one thousandth of an inch. The ribs are now ready for bending and for this procedure he uses a bending iron also made by himself. It can be seen that Slaby prefers to make his own tools whenever this is feasible.

After the ribs have been bent he lets them dry out thoroughly, meanwhile utilizing this drying out period for the carving of the scroll. Slaby's scrolls, with their graceful contours, are aesthetically pleasing and are characteristic of his artistry. When he was asked what possible reasons there might be for the success of his scrolls, he replied that many violin makers are not successful because they are afraid to take off wood. But more important, the carver of scrolls frequently has an inadequate conception of what he wants the scroll to look like. This can be illustrated further by an analogy from the teaching of lettering in drafting. To become a really good letterer you first must have the correct concept of the letter. Slaby says that from this point on you merely practice until your work achieves perfection. He advises scroll carvers to work more freely and to be less inhibited in their approach.

For working on the rib garland, Slaby uses an inside mould of the sandwich type in which the top part can be lifted out and the linings put on the backside while the ribs are still on the mould. After the curves of the corner and end blocks have been cut close to the line with a jig saw, he finishes them with a 1/2" diameter drum sander held in a drill press. This insures that the curved surfaces of the blocks will be perpendicular to the plane of the top and back. The ribs are then glued to the corner and end blocks. Incidentally, Slaby uses the standard violin makers' flake glue for this and other glueing operations on a violin. Occasionally, however, as in glueing the center join of a two-piece back or top, he prefers to use Weldwood urea resin glue because he wants a permanent bond at this point.

After the rib garland has been completed, Slaby centers it on the back wood. Then he uses a margin marking tool of his own design ("Margin Layout Tool", VMJ, Oct.-Nov., 1961, p. 18) which accurately projects the edge that he wants for the finished back plate. Slaby saws to this outline but deliberately leaves a margin of approximately 1/16". For bringing the plates to the exact outline he uses a disc sander for the large outer curves, and for the inner curves he uses a small drum sander in a drill press. The edge of the plate is reduced to the thickness he wants (generally 9/64") by means of a square end routing bit which is inserted in a purfling machine of his own design. A 1/16" diameter Weldon end mill is used for the actual cutting of the purfling groove, after which the purfling is then inserted. For sinking the channel inside the edge he uses a 3/4" diameter corebox routing bit, although a smaller size can be used for this purpose if a violin maker prefers. Some more remarks about purfling: Slaby purfles the back and top before routing out the inside of the plates. Also he now uses wood purfling exclusively on his instruments. In the past he has experimented with fiber purfling but there are two reasons why he no longer uses it. The corebox router with which he sinks the channel has a tendency to generate heat which in turn softens fiber purfling to the extent that it will not cut off cleanly. Also, in sanding plates, particularly the top, Slaby finds that fiber purfling is harder than wood and does not sand off readily. Fiber purfling may then have a

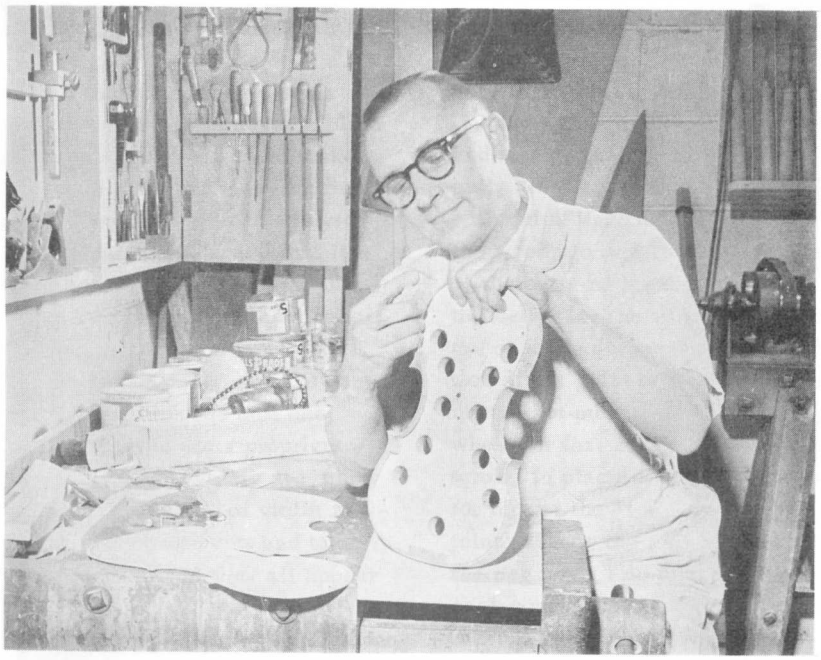
tendency to stick up and form a ridge.

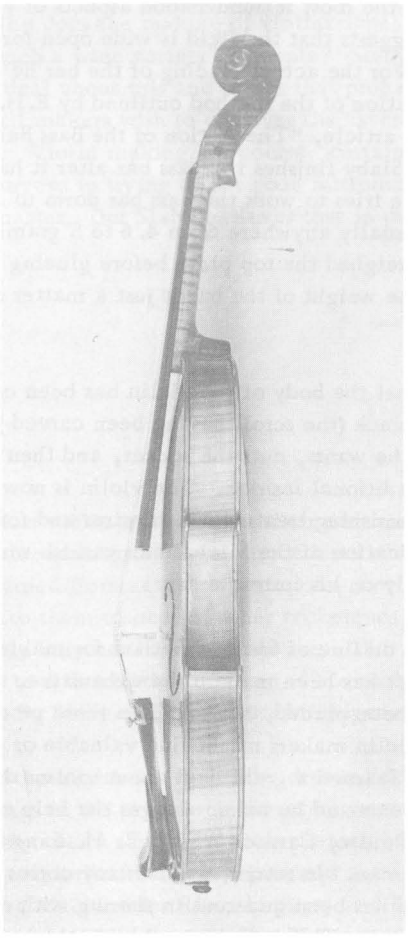
When the back is completed in its entirely except for the button, the rib garland is glued to the back and Slaby then projects the margin for the top plate. For both the top and the back he uses a drill press for drilling small depth holes in the plates as an arching guide. For routing out the plates he uses the shave blades which he has previously described ("Curved Blade Violin Shave", VMJ., Feb. 1960, pp. 15-16). In shaping the plates with this tool, however, he still leaves plenty of wood so that the final finishing can be done with scrapers and planes. Slaby cuts the F holes in the top before the final graduation is completed; this is necessary because of his method for tuning plates. One might wonder about the possibility of damage to the wings of the sound holes if the final graduation is completed after the holes are already cut, but Slaby minimizes this possibility with a simple technique which he uses. Around the immediate area where the sound hole is to be cut he applies a thin coat of Elmer's glue to the underside of the top. The glue dries transparent, makes the cutting of the sound holes easier, and minimizes the danger of damage to the delicate edges of the holes while the maker is working on the graduation.

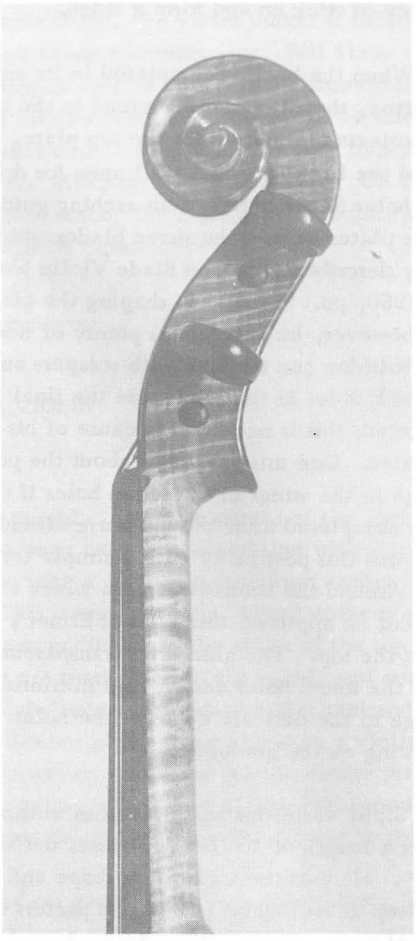
Slaby varies his bass bars from violin to violin. He prefers a length of 10 1/2" and varies the width from 3/16" to 1/4". He uses the traditional shape and keeps the bar 1/2" deep at its highest point. He prefers to "spring in" the bass bar when glueing, although he is not quite sure what effect this has on a violin's tone. Slaby is inclined to agree with the statement that the action of the bass bar is perhaps one of the most misunderstood aspects of violin making and suggests that the field is wide open for scientific research. For the actual placing of the bar he uses a slight modification of the method outlined by E. H. Sangster (see Sangster's article, "The Action of the Bass Bar", VMJ, June, 1961). Slaby finishes the bass bar after it has been glued in and he tries to work the bass bar down to a certain weight, usually anywhere from 4.6 to 5 grams. Since he has weighed the top plate before glueing the bass bar, finding the weight of the bar is just a matter of simple arithmetic.

Now that the body of the violin has been completed he shapes the neck (the scroll having been carved previously) to the end he wants, cuts the socket, and then glues the neck in the traditional fashion. The violin is now ready for any pre-varnishing treatment he desires and for the eventual application of the Michelman varnish which he uses exclusively on his instruments.

In this outline of Slaby's method for making a violin, no attempt has been made to be exhaustive. An emphasis has been placed, however, on those procedures which other violin makers might find valuable or useful. Bill Slaby has learned a great deal about violins during the past few years and he acknowledges the help of such men as Josef Deulin, Carmen White, E. H. Sangster, and Joseph Michelman. In return, as his many correspondents can verify, he has been generous in sharing with others what he himself knows. This is as it should be, thinks Slaby, for it is axiomatic that in the world of violin making no man is an island unto himself.







The Technique of Violin Making

By Harry Wake

There has been so much written over the years about varnishes and varnishing; about what should be done and should not be done; about the virtues of this or that type, or method of putting it on, that it would be superfluous here to make any statements or claims; we will, however, show you how to do a good job of varnishing, and how to select your material.

In the last chapter you had your violin finished in the white and fitted up for playing; it must now be stripped down again for varnishing. Remove strings and bridge, pegs etc. also the fingerboard; many makers varnish their instruments with the fingerboard on, but believe me it is considerably easier to take it off: If your instrument has had any playing at all while it was in the white, or if it has been handled at all, wipe it off well with lacquer thinner or benzene; especially at those places where the hands go when playing; because the oil from the hands is on the wood and this will prevent the varnish from adhering as it should. After this cleaning operation try not to touch the wood of the body of the instrument; the neck will not be varnished so handle it by the neck and with a stick placed in the tailpin hole at the bottom.

Perhaps you have already done some experimenting with some of the many varnishes available, or perhaps you may have decided to make your own by Jos. Michelman's process; if you have, you will start getting the materials together and making the rosinates; the author has done a good deal of experimenting with the Michelman process with more or less good results; however I have never applied it to any of my finished instruments. If you wish to make your own varnish by other processes there are many formulae in Heron-Allens book, but will take you a year to analyse these and find out what it all means. I might add that it is very frustrating and messy dissolving gums in alcohol, mixing in some turpentine and then evaporating off the alcohol; it can be done and has been done, but it takes time and patience; then you have the problem of smells and the danger of fire. Your next choice, and I think the best one; especially if this is your first fiddle, is to use a proprietary varnish and you have a good selection here; there are many good varnishes available through the suppliers of violin making materials. Just look over the advertisements and take your choice. I have tried most of them and they all appear to be good; however some will dry a little faster than others; some feel a little different under the brush during application and are a little more difficult to handle. Some brush on easily and dry well in a reasonable time; the best suggestion that can be offered is that you purchase sample bottles from various sources and run a series of tests. You should then be able to decide what suits you best.

Having settled this point you must prepare the instrument; regardless of whose varnish you use, you must seal the wood by sizing or priming; this is usually a combination of gums dissolved in alcohol and is naturally quick drying. It can be bought at the same time that you buy your varnish. Follow the directions and apply sufficient to assure proper sealing of the surface pores of the wood. Place small corks in the peg holes and cut them off flush with the outside cheeks of the peg box; this will keep the varnish out of the holes.

For applying the varnish I find that a fairly stiff brush about one inch wide and of the type having a long handle is excellent; however before starting with the varnish, go over the work carefully and lightly with very fine dry sandpaper to remove any specks, wipe off lightly with the flat of your hand; your hand will detect tiny specks and particles that you sometimes cannot see. The first coat of varnish after the priming should be clear; this is to prevent any possibility of the color penetrating and staining the wood; in applying the varnish I find it best to start at the bottom of the neck, then the upper ribs to the Cs, then right around the bottom; put a stick in the tailpin hole at the bottom to use either as a rest or as handle and with very little varnish on the brush do the inside edges of the Fs, and around the Fs, always working precisely, quickly and surely, making sure that you lay it on; then cover the belly all over, brushing diagonally then finish the top with quick light strokes in the direction of the grain of the wood; go now to the back which will be easier to do, as there are no breaks in the surface area as is the case on the belly; lay the varnish on and brush diagonally, then the opposite diagonal and finally very lightly in the direction of the grain or straight up and down. Don't make the mistake of putting it on too heavy on the scroll, or anywhere for that matter. But it has a habit of running on the scroll, in places that you don't catch right away. Watch for runs at the Fs and at the top of the belly at the neck joint, also at the area of the head where the scroll joins the peg box. Brush out any runs immediately. After each coat has been applied, you can support the instrument in a horizontal position by placing the stick that you use in the tail pin hole in a vise, and make sure its

tight. Leave it with the Fs up for a while then turn it over and leave the back uppermost. This will discourage the varnish from running, especially at the Fs where they are difficult to rub down later. When the varnish has 'set' you can hang the instrument by a cord around the neck in a dust free place. Your local climate will have a great deal to do with how you do your drying, and for that matter how you do your varnishing. Varnishing a violin in S. California is a lot different to what it would be in Manchester or Copenhagen. You may find it necessary to build a light box and let the electric bulbs do your drying. Whichever way you do it, and no matter how careful you may be, you will always find tiny specks on the surface after each coat is dry. These must be removed before any more varnish is applied. A gentle going over with very fine dry sandpaper will serve a double purpose. First it will remove any specks and second it will leave a non-glossy surface to which the next coat will take better. With the coat of clear varnish dry and the surface gone over carefully you can prepare to apply some color. If you intend to use any of the red, red-brown, or orange-red colors, your first color over the clear should be a good yellow. This gives a good reflecting surface and adds life to the reds. You must carefully go over the whole job between coats and remove all specks using the finest sandpaper as before, and now for the sake of this description we will assume that you are going to use a red-brown varnish. You will lay on the first coat of that color over the yellow. This first coat won't make much impression other than to change the bright yellow to a light amber. The next coat will show more change in depth and if you are going to do any shading now is the time to start. If this shading of the varnish is tastefully and artistically done it can really set off a violin but on the other hand if it should be overdone it can make the instrument look glaring and sheap. Apply the varnish as you did before, starting at the bottom of the neck and then the upper ribs; however after having done one of the ribs, lift some of the varnish off with the brush and quickly go over this area lightly to blend the lighter into the darker areas. The places that will be shown lighter will be naturally those where an instrument receives wear; at the shoulder where the left hand goes; at the bottom in the chinrest area, at the center of the Cs and a little on the center of the sides. Work fast and don't try to take too much off because subsequent coats of color and careful lifting off in the areas mentioned will develop contrast between light and dark.

Proceed with the belly after finishing the ribs, the lightened areas on the belly will be at the top where the left hand goes and at the bottom in the chinrest area, sometimes slightly on the opposite side to the chinrest. The back is next and this is where you can really show your talent. Do the whole back in the normal way, then lift off a good section at the middle, followed by both sides at the bottom, but a little more so on the chinrest or shoulder side, then at the top where the player rests the left hand. After each lifting, empty the brush by drawing the bristles across the lip of the varnish container and finally go over the work lightly with the brush to blend each lightened area into the darker areas. It will now take several coats to build up color to the depth that you want and by working the shaded areas each time as explained above you will get an artistic job with not too much contrast. When satisfied that you have sufficient depth of color you can finish by applying two coats of clear varnish, always sanding lightly between coats. You can now put the instrument away and leave it long enough to get well set before attempting any rubbing down.

The materials you will need for rubbing down are fine grade pumice powder, rottenstone powder, and an old felt hat. Cut the felt into pieces about one inch by two inches. We will use water with the abrasive, the powder cuts better with water as a medium and is a lot easier to wipe off. Find a bottle having a squirt or spray top attachment, fill it with water and add a few drops of detergent. This makes the water more wet and it carries the abrasive better. It is also a good idea to keep the pumice and rottenstone powders in small jars having perforated lids or tops, so that you are better able to control the amount of powder used. Take one of the pieces of felt and wet it well from the bottle of water. Sprinkle the back of the violin with pumice powder and squirt on enough water to carry the abrasive. You will find that it takes quite a lot of rubbing, but work in all directions until you have gone over the whole of the back. Spray on more water occasionally to keep everything wet all the time and then wipe off completely with a piece of rough towel (terry cloth) material that has been wrung out in water. You will now be able to see what progress you are making towards removing all the pimples and 'orange peel' surface. Rinse out the piece of felt that you have been using or take a new piece and start again with the pumice. This time you can work on smaller areas, and wipe off with the damp rag often so that you can watch your progress. Rinse out the felt and wiping rag occasionally, and keep working until you have a perfectly smooth surface and no signs of roughness anywhere. When working the edges and corners you can fold the felt and use the radius of the fold to work with. Now when you wipe off the surface with the damp cloth you will be able to see and appreciate the shading of the varnish on the back. You will most likely want to do the belly next; however it doesn't matter much as long as the whole instrument is thoroughly gone over and brought to perfect smoothness. When this is accomplished you must wipe off completely with the damp cloth to remove all traces of the pumice. Sprinkle the back now with rottenstone, spray with water from the bottle and with a new piece of felt go over the whole of the back. The rottenstone powder has a way of losing its bite if it is not kept quite wet, so keep plenty of powder on and spray often.

(cont'd. on page 17)

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Use a clean piece of wet towel to wipe off and repeat the whole operation; now if you are anxious to see what your work really looks like you can go over the back with a good fiddle polish. What you see I am sure will encourage you to go ahead and get the remainder of the instrument finished, with this being done you can replace the fingerboard, remove the plugs from holes in the peg box, and very lightly ream the holes to remove any abrasive or varnish that might have got in. When the clamps are removed from the fingerboard we can put the finish on the neck. With file and sandpaper you must get everything clean and smooth. Wet the wood and allow to dry, then sand again. At the top and bottom of the neck where the varnish ends, use the sand paper to get a fading out of the varnish. The neck must be stained to bring out the grain of the wood and for this we will use permanganate of potash; mix a few of the crystals in water; it doesn't take much and makes a very dark stain which turns brown. Keep it off the fiddle varnish but sop it on the neck and let it soak in. It will turn the wood a very dark brown but don't let it bother you as most of this will disappear later. Incidentally you can bleach it out completely and also remove the stain harmlessly from the hands with photographic hypo. Allow the stained neck to dry thoroughly and then rub in raw linseed oil. Put plenty on and let it soak in, then soak a piece of old worn sandpaper in linseed oil and start sanding the neck in a gentle circular motion all over the stained area. Don't work up and down or you may get streaks. Keep a little oil on the sandpaper and most of the dark stain will disappear leaving only the grain of the wood accented. The neck will now be french polished and for this you will need the linseed oil, orange shellac, and a piece of lintless shirt material. Wrap the cloth tightly around the index finger and put the slightest touch of linseed oil on it and then a good dip of shellac. Rub this in a continuous circular motion all over the neck area. Touch the cloth again with oil to prevent any tendency to stick, and some more shellac to build up a surface on the wood. Keep working in a circular motion until you have built up a good surface coating. This is french polish and will last for years. You can now set up the bridge and strings and 'VOILA' your fiddle is finished.

* * * * * * *

EXPERIMENTS AND THE ANSWERS THEY GIVE

by Leo D. Larsson
San Francisco 14, California

The history of the violin from the earliest makers up until today is a story of experiments. The violin reached the peak of perfection in the period around 1700, about fifty years before and a little less than fifty years after that date. After that time there were only a few isolated makers who could consistently produce outstanding toned instruments. This is so unlike other stories of research and improvements of products, materials, methods etc. because the experiments of the violinmakers of the last two hundred years has been to try to equal the best products of the makers of the period around 1700.

Most of the early makers experimented with the outlines, archings, size, shape, position and opening of the sound hole. Length of the instrument was varied as well as the top, middle and lower measurements of the breath. Various types of wood were used, thicknesses varied including those of the ribs, also the depth of the ribs changed. These then were all experiments and each maker arrived at his answers that gave excellent violins that live to this day. So where do we go from there? Nowhere: - only trying to duplicate the beautiful elusive tones produced by these masterpieces made around 1700. We want this same tone quality, the same volume, the same carrying power (a vague description), the same ease of tone production and a varnish that is the same used by the old masters.

To experiment or not to experiment is a question pondered by many makers. I believe every instrument made is an experiment and an experience when completed. However much of the experiments carried out by many makers are just a waste of time.

For research first the maker should have the ability and training of objective observance. A wide reading background of the history of the violin, something not easy come by. Most of the books are out of print, sometimes items of importance are found in books not directly concerned with violins such as history of music books and oddly enough the back issues of the U. S. Patent Gazette. Third is to have the patients and persistence to follow up clues observed and develop further tests. Fourth is to have the ability to analyze, reject or accept conclusions and work towards applying the conclusions reached to standards of construction as well as design handed down from the old masters. Innovations and freak ideas to attempt to gain the same goal are definitely doomed for failure as well as an admission of failure to achieve results by the accepted standards of the old masters.

Some experiments of the nineteenth century are accepted standards today by makers and repairs. In fact it is the master repairers with their experiments in the last century that have brought out the latent power that was built into the old master violins. By variations in the length and sizes of bass bars, sizes of sound posts, bridges also lengthening and varying the angle of the neck have brought results never dreamed of by the old makers. However these old instruments were properly constructed to begin with so as to be able to take these extra stresses placed upon them.

The design of the violin can be compared to the engineering of a large arch bridge. Some supporting struts at angles are used between the bridge deck and the arch, but the arch is the main support of the bridge weight and the load carried.

The violin has pulling stress from peg box to tail pin when the strings are pulled up to pitch. This stress is increased as well as constantly varied by the bow and fingers when being played. There are also some side stresses developed when playing. There is a very heavy stress put on the top and to the back by way of the sound post by the strings anglying over the bridge. This pressure is also increased and varied when playing.

The principle of the arch bridge is adapted in the design of the violin. However the pressures and stresses are very complexed so the violin is designed with a series of arches at different angles to give the counter acting strength. The ribs are a series of arches to counteract the pulling of the strings from end to end as well as spacing the arched top and back plates. The ribs also increase the strength of the middle part of the instrument as well as the side stresses from the playing. The strength of the arches of the top and back plates are of prime importance. They combine with the ribs to counteract the pull of the strings from peg box to tail pin. Further strength to the top plate is given by the arched bass bar. Why the arch? It gives strength to building with less weight.

The neat balance between the correct engineering principles and all the vaguely known factors that the maker incorporates into the instrument makes for the degree of success.

There have been instruments made with the top and back plates high arched, medium arched, flat arched and one plate much more arched than the other. Generally, the high arched instruments were somewhat thinner in the top and back but the strength was compensated by the higher arching. The early German makers as well as a few of the Italian families followed this principle and many excellent instruments have been produced. Most of the finest Italian makers used a medium arching, some a little flatter. This design had to have slightly heavier thicknesses to give the needed strength to the flatter arching. Then there were the flatter instruments, usually French and somewhat larger in size, but not many were successful with this design compared to the others.

Don White has carried out an interesting and successful experiment as described in the November-December issue of the Journal. This is not a criticism of Don's work in the past or research efforts. First, he tells us in one paragraph the theory behind his program, compressions taking place when the violin is brought up to pitch. He through an experiment and in the last paragraphs of his article he gives us some thoughts on the experiments. Excellent work, Don.

How does this experiment fit in with the remarks on experimenting? It should be said Don has filled in the requirements of 1, 2, 3, on 4 he has shown ability to analyze, shown willingness to reject or accept by asking for other's opinion and experiences. However, the biggest hurdle remains; to apply the lesson which he sees plainly, to the standards and designs handed down to us by the masters. It is a tough one, Don, but at least you have realized and seen the problem which is more than can be said for thousands of makers.

The compression you mention can be seen in many old as well as not so old instruments which usually end up with quite a bow in the back. Some instruments do not stay in tune when or after playing in the higher positions. The cause is usually weak archings particularly in the back plate. Your experiment proves what an instrument will sound like when this weakness is overcome.

Now the problem is to construct the instrument without the brace by increasing the engineering strength of the archings, but still get the ease and freedom of tone with quality. Farrell worked on this problem fifty years ago and wrote a book on his method "The New Toned Violin". It must be presumed his method did not work out as I have not heard of a Farrell violin or seen one listed in a dealers catalog.

The old masters correctly engineered and produced instruments that are marvels for tone and the matching of these instruments is the goal of every maker. Proof of this fact is that they surpass most instruments produced since their day and take the increased stresses modern pitch and playing place on them.

Experiment, use innovations in tests, if these innovations give good answers then apply the lesson to solving the problem in the instruments laid out by the master designers of violins. Only then are you getting to the truth of what makes a good violin made by the old masters.

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THE CASE FOR THE MODERN VIOLIN

by C.F.G. WELSTEAD

(continued from November-December, 1962)

Eventually I reached the stage where seriousness really took over from mere interest, and one by one, the gums and resins listed in the old recipe books were made the basis for intensive research - sandarach, tragacanth, elemi, benzoin, etc. etc., and after some four years my conclusions were that none of these substances were ever incorporated in the Cremonese varnishes - they were all too pale and could not be charged with a deep red colour which would remain light-fast, and all the reactions with metals were green (as observed by Christian Skou) with the exception of iron, which gave a brown varnish, and then one day, while experimenting, and wondering if the pursuit was worth while, I noticed in my test-tube rack some experiments I had set some two weeks previously in half-inch test tubes. These test tubes were placed in the rack which is placed on a ledge exposed to the filtered sunlight which is diffused by heavy optical glass, and each of the varnishes in the tubes were of a deep colour - each one of them predominantly red, as follows:

Tube No. 1 was charged with the basic resin dissolved in rectified turpentine, and the metallic element was copper; the varnish was a beautiful orange red colour as clear as crystal; the varnish was a beautiful orange red colour as clear as crystal; no reaction (visible) appeared to be in process at the time of observing, and subsequent production of this copper induced colour has not reacted in any of the usual ways (i.e.) evolution of gas, heat, or fumes - this varnish when brushed on a piece of pine or maple displays a magnificent orange to red colour, according to the length of time it is in contact with the copper (copper powder was used, being the most convenient).

Tube No. 2 - the same as No. 1 but charged with magnesium powder - the resultant varnish being a blood red cólour and just as excellent in quality and texture - a small percentage of oxidised oil can be used with this varnish as the magnesium is an excellent drier, and causes the varnish to dry too rapidly. This reaction is accompanied by the evolution of hydrogen gas, and acceleration is gained by preparing the production in the following way: Place the required amount of basic resin in solution in a glass container, then add a small quantity of the magnesium powder, and allow it to settle in the bottom of the tube, then add a few drops of distilled water which will sink to the bottom of the tube, and the reaction commences at once. Daily agitation by means of a glass rod is necessary, and when reaction stops, add a few more drops of H_20 and agitate again - the varnish is ready for use at any period of the process according to the depth of colour required.

Tube 3 was charged with chromium granules, chromic acid (H_2Cr0_4) or chromic oxide (Cr_20_3) I find the chromic acid more convenient; it is incorporated in the following manner: Place the basic varnish in the test tube tube in the usual way, then dissolve a very small quantity of the chromic acid in some distilled water till a concentrated solution is obtained, and place a few drops of this solution by means of an eye-drop tube or capillary tube - only a small amount is necessary. The product is the reddest of red varnish which is also very rapid in drying.

Tube No. 4 was reacted with powdered gold, and resulted in a rich brown varnish of the Amati type - silver filings give the same result.

Tube No. 6 was reacted with iron (Mr. Skou will be keen about this one, and I would advise him here that the many ways he adopted to create a reaction, and his puzzlement concerning the actual cause of same, is not the iron itself, or the oxide). In the usual way, place a small quantity of the basic resin in a tube, then drop a few granules of iron filings into the resin which will rapidly sink to the bottom of the tube, and add a few drops of water; the reaction will begin within a few minutes. This reaction is, as far as I am able to discern, brought about by the degradation of the metallic iron by oxygen whilst in contact with the resin; if a rapid reaction is preferred, a solution of ferric chloride ($FeCl_3$) or ferric hydroxide (Fe_20_3) can replace the iron metal and water - this produces a rich brown varnish in a few minutes.

The experiments just listed represent a small portion of the actual total number carried out, and I have nominated them in order to show that this highly reactive resin will produce varnishes of deep colour from many other metallic sources, and also by the use of many of the metallic compounds in common use.

After using this varnish on the violins I have made, I cannot visualise any other material which can measure up to it in any way, because by trial and error I have arrived at the conclusion that the tear of this resin was possibly available to Stradivarius and was and is the "Pure red sovereign gum" of the romanticists - yes, I believe that the tear of Gamboge is the long sought after ingredient of the Cremonese varnishes - it is not available today, but this is not important because the pure oil soluble resin can be extracted from the crude pipes which can be obtained from any wholesale drug store today, (if your purse is big enough) because it is expensive (in Australia anyway) about $12.00 per lb. and approximately two thirds of this weight is the oil soluble resin portion - the remainder, a water soluble gum or mucilage - excellent for the purpose of adhering labels to the inside of violins?

Prior to detailing the process I have evolved for extracting the resin from the crude material, it is I think, important to give to the readers of the Journal some information regarding the chemistry of this substance. Unfortunately, little has been done in the field of chemical analysis on this resin, and consequently, there remains a vast amount of research to be instigated - perhaps Joseph Michelman may consider the task worth while after he verifies my statements - I give here, however, all the information I have been able to find in this country.

* * * * * * *

Gambogin or Gambogic Acid

Source of Information: "The Analysis of Gums and Resins" by Dr. Karl Dieterich, and revised by H. B. Stocks, F. I. C. F. C. S.

Publication: Scott, Greenwood & Son, London, 1920.

Description: A gum-resin from Siam, East Indies, and India, extracted from Gambogia Cowa and Gambogia Guttifera.

Chemical Constitutents: Gum 13.8% Resin, or Gambogic Acid 70% ($C_{30}H_{35}06$). Wax and ash, vegetable detritus; no ethereal oil. (Gum 26%, Resin 66%). The gum although soluble in water, is according to Fluckiger not the same as arabin.

An Analysis by Williams

Acid Value	80.6%
Ester Value	67.2
Saponification Value	147.8(hot)
Iodine Value	115.8
Ash Value	0.8
Moisture	3.70

According to Sassarini, Gambogin contains a gum analagous to arabin, volatile oil consisting of a terpene and camphor, isouvitnic acid, a phenol, ester, resin methyl alcohol, and its homologues, and an aldehyde or keytone. It comes onto the market in the form of pipes up to three inches thick; also cakes or lumps of reddish yellow colour covered with a yellow powder and large conchoid fracture (Lustrous) specific gravity 1.221 at 20 degrees C. It floats in carbon disulphide at this temperature, but sinks at higher temperatures; and they furnish a yellow emulsion with H_20. The mass is plastic at 100 degrees C; it is partially soluble in H_20, alcohol, and ether, and the solution has an acid reaction.

The chemical formula, as stated above, ($C_{30}H_{35}0_6$) I think is erroneous; there is one other given by Buchner ($C_{30}H_{56}0_6$) which is in my opinion nearer the truth of the actual structure of the molecule of this substance. Some inconclusive work carried out by myself and a friend who is an organic chemist came up with the formula ($C_{30}H_{30}0_6$) after an extended micro analysis, but I am not satisfied that our work is of high enough order to be taken as final assessment - the question requires a more intensive investigation than we are able to organise; I personally believe it to be a triterpene, but whatever the outcome is in respect of the chemical and physical constitution of this resin, I know for certain that it is the only resin which reacts with metals and metal conpounds to give a brilliant red varnish of unparalleled beauty and texture, and the varnishes produced from it are made without the influence of heat; this is possibly the reason why the majority of the old Italian masters lived to a ripe old age instead of being blown up by some chemical reaction occurring during the "cooking" of varnish, a process thought by many to be the only way to produce a violin varnish of a deep colour. My best quality varnish is produced by using copper metal in contact with the resin, and since it is not possible to purchase a vessel of the correct size for the job, I made use of copper powder, which is available from any chemical supply house, and its production is carried out in test tubes of varying sizes according to the amount of varnish required.

I have given sufficient details previously in respect of the methods used to produce red varnishes from various metals, and in the following chapters will concentrate on the use of copper, but first, I would like to inform the readers of this article that I do not evade the application of heat to these processes for the reason that this factor will change the nature of the resin, but because it has no influence on the reactions which occur, in other words, its application does not accelerate the process of producing varnishes from Gambogin; to find the tolerance of this substance to heating; I have taken it up to 180 degrees C, before a reaction occurred, and at this temperature, the

(continued on page 23)

reaction was sudden and violent; the product, an insoluble black mass of brittle resin which apparently reaches a critical point of carbonisation by degradation at around this temperature.

To extract the resin from the crude cakes or pipes, proceed in the following manner. Take one pound of Gamboge (you will need this amount if it is your intention to make a stock solution for the purpose of experimenting) and reduce it to a fine powder in a large mortar bowl (while engaged in this part of the process, protect yourself by wearing a mask or at least some means of filtering the air you breathe because this resin is a powerful irritant to the mucous membranes of the nose and mouth). When this has been done, transfer the powdered Gamboge to some clear glass containers with wide tops, and dissolve it with the ordinary commercial methyl alcohol. If, during this part of the preparation the containers are immersed in hot water, the process will be much quicker. When the mixture has been thoroughly stirred with a clean wooden or glass spatula, allow the sediment to settle for an hour, then syphon off or decant the clear resin in solution into a straight sided beaker (1000 cc is a handy size) and place this container on the water bath in order to commence the distillation of the alcohol - this requires regular agitation with a clean flat bladed wooden spatula (about three quarter inches wide by one eighth thick). Continue to add alcohol to the crude resin residue, decanting the clear resin solution into the beaker on the water bath. This process should be continued until the liquid separating from the residual Gamboge is so pale as to make further extraction unnecessary.

When you are satisfied that all the clear resin has been extracted from the vessels, put the residue aside for the purpose of mixing with hot water; as stated previously, it makes an excellent adhesive for placing your labels when the instrument is finished.

Your attention now must be concentrated on continually stirring the clear deep coloured resin on the water bath, and when the resin reaches the viscosity of syrup; add slowly 50 cc of rectified oil of turpentine, (there is no need to oxygenate this first because the resin is perfectly soluble in this medium).

Continue to stir the mixture until all the alcohol is driven off (this will be known when the mixture ceases to give off bubbles and vapours of alcohol). To ascertain that this point has been reached, agitate with the spatula rapidly, and if no further reaction is occurring, you can be satisfied that your solution of Gambogin is practically ready for storage.

To be certain that the last traces of alcohol are driven off, leave the solution on the water bath at 100 degrees C for one hour - this will not create any change in the structure of the resin - I have allowed a small amount of this resin to remain on the water bath for up to four hours without any change taking place, for as stated previously, a much higher temperature is required in order to dehydrate this material. Together with this manuscript, I am sending to your editor, Mr. White, a sample of the basic resin in solution, and some samples of the resin reacted with various metals and metallic compounds in order that those who are interested in your country can contact him direct for any information regarding the colour, texture, and general characteristics concerning this varnish.

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Summary

Much could be said here further to the foregoing on this subject, but it is beyond the scope of this manuscript, and I shall perhaps elaborate more later, consequent upon the remarks which will be stated in this Journal by its many readers, either for or against my claims, but of one thing I am certain, and it is this: If the literature on this subject over the last fifty years or so (I am speaking of the statements which are acceptable to the majority as fact and not fiction) is in fact true, then my remarks must stand.

The varnish covering my instruments behaves in exactly the same way as described by many writers on the varnishes of Cremona - Charles Reade observed that the varnish on the old master violins is chippy by nature, leaving a pale yellow stratum of combined wood and basic varnish beneath. I have purposely chipped off small portions of varnish after several years and observed the same conditions to exist; these flakes are perfectly soluble in alcohol.

All the conjecture concerning how the old Italians varnished their violins by using a different mixture for priming the wood, I consider erroneous in the extreme, simply because this procedure is not in the least necessary. My own varnish (the very deep coloured one) when diluted for the purpose of priming the instrument, is a brilliant yellow, and if this same varnish is used undiluted, one coat gives the deep yellow colour not much deeper than the priming coats, but from thence onwards the colour of each successive coat becomes darker - one thin coat is light orange, then next orange, the next deep orange, the fourth coat is orange/red, and the fifth coat is sufficient to colour the instrument to an attractive shade of light red, and my

personal taste does not go beyond this degree, but if coating continues until eight applications have been made the colour is the deepest red desirable, and the clarity is perfect; the thickness of the dry pellicle of the reddest varnish is in the vicinity of 0. 10 mm.

At a later stage, I would be pleased to describe the method of preparing an instrument for varnishing, and step by step give full instructions for the procedure of applying the top coats of varnish, and lastly, the method of hand finishing the varnished surface; I can assure the readers of the Journal that when this has been completed, you have before you an instrument of infinite beauty, which as the years pass becomes if anything, even more beautiful.

Finally, I emphasize my belief that the modern violin, if constructed according to the laws of harmonic balance which undoubtedly is the prime factor in a concert instrument, is superior in every way to violins of the past. In making this statement, I make only proviso only - THE VARNISH LAID UPON THEM MUST BE COMPATIBLE WITH THE EQUILIBRIUM BUILT INTO THE INSTRUMENT - more excellent violins have been ruined forever by the application of the wrong type of varnish than from any other cause.

The belief that the old violins are more powerful and resonant than the modern ones, does not so far as I am concerned convince me - I have heard them all played here in Australia from the same seat in the Sydney Town Hall, Alfredo Campoli, David Oistrakh, Christian Ferras, Ruggeiro Ricci, Yehudi Menuhin, etc., and from the same seat I have listened to my own instruments in performances of the Concertos of the Masters played by lesser performers, and I try to visualise one of my instruments in the hands of say Isaac Stern, who, incidentally has little faith in the modern violin, and indeed, this belief seems to be prevalent among the virtuosi of all countries, and it is upon this note that I desire to conclude this article.

It is possible that the modern virtuosi is prejudiced by virtue of the inflated price they pay for one of these ancient instruments - let us suppose for instance, that Isaac Stern could be induced to perform publicly on one of my violins, and that it did in fact convince him that the modern instrument was equal to or even superior to the old ones - would he be wise in saying so, and depreciate the monetary value of his old Italian - I think not, but the time must come when the top line performers will give credence to the modern maker; at least they should be prepared to give as much credence to this as they give to some of the dealers who purvey "genuine" old Italians at any price they think fit. Large sums of money exchange hands quite often in barter for some "certificated" master instrument which could be outclassed and out-played by a dozen modern instruments - harsh words, but true (if this is doubted, then read the Time Magazine (December 29, 1958) under the heading 'The Imposter Strads") and even if some of these ancient relics of the past are genuine in respect of the faded label attached to a patched-up interior, the tonal value is probably less than many superb modern violins which are relegated to the cheap and nasty class because the mighty virtuosi consider it beneath their dignity to condescend and give fair trial to some of these excellent Twentieth Century instruments - further, it is a sad thing indeed that the leading players of the violin in most countries consign the modern maker into the limbo of the "crackpot" class - we are cranks, dreamers, etc.

This attitude is suffocating, and represents to me at least, a challenge to the intelligence and superior knowledge of modern man - would Mr. Stern for instance, accept a statement that if Mozart lived today, he (Mozart) could outplay him? I think not - here is a classical example of the general attitude of the leading virtuosi of today, quoted from Joseph Szigeti's book "With Strings Attached" he says:

"...I have seen many of these rhapsodists and listened to their talk, but I don't recall ever hearing that any of them actually played the violin - which would be the kind of proof of violin theories that eating is of the pudding. For the procession of such visionaries has been unending in my life, from those early days in my father's house up to the present time."

This statement is typical of the majority of present day performers, professional and amateur alike - they live for the day when one of the old master instruments will come into their possession and the brilliant exponents of the art who play upon them insist that such an instrument must be good because Stradivari made it, and Mr. So-and-So certificated it - romantic nonsense again - we must remember that these ancient relics of Cremona and Brescia are the products of "cranks" and "crackpots" who lived a couple of hundred years ago, and achieved their mark by sincere application to hard work and experimental trial and error. It must also be remembered that Amati, Guarnari and Stradivari did not make their instruments to be played by Mr. Szigeti and his contemporaries in the Twentieth Century, but rather for the pittance which offered at the time - the fact that Mr. Szigeti can play upon one of them, is entirely due to crackpots like Luigi Tarisio and others of his ilk who passed them on one way and another, after keeping them for a lifetime merely to be looked at from time to time - the majority of these old master instruments would still be in mothballs but for the appearance on the scene of astute business men like Jean Baptiste Vuillaume who exploited the heirs of the mendicant Tarisio, and established for all time what could be done with

merchandise from Cremona; it is therefore encumbent on Mr. Szigeti to be grateful to all crackpots associated with the art because he is indebted to the crackpots of the past by virtue of the fact that they were responsible for the creation of the violin, viola, 'cello during the early days of Cremona - intense experimentation was the order of the day, and out of it all emerged the king of musical instruments, not only because genius existed in Italy, but because intense hardworking men applied themselves to the production of works of art.

My remarks may appear a trifle severe, but of all the human frailties, I find smugness the most deplorable - most of all the brand of smugness adopted by the majority of English, American and Continental virtuosi, not so much because they become hide-bound, but because they become isolated from people like myself who believe that something has been achieved by hard work and study over many frustrating years - their assistance and opinions would be of immeasurable value in giving an occasional audition in order to assess the tonal value of a modern instrument!!

If the virtuosi of the present day were a little more like the fine fellows of the scientific world in co-operating with those of us who consider that something has been achieved, it would be a fine relationship - I have on many occasions over the last few years approached the Professors of our Universities here, to ask for assistance in many fields - I have many times stated my case to Professors of Chemistry, Acoustics, or Wood Technology, to be greeted not as a crackpot, but as a fellow with something to say; many times these interested men have been of great assistance to me in resolving problems relating to the constitution of resins, and the structure of wood, etc.

During a period of some ten years I have endeavored to have my violins test played by practically every concert violinist to visit this country - Alfredo Campoli, Max Rostal, Ruggerio Ricci, Christian Ferras, Isaac Stern etc., only to discover that it would be far easier to arrange an interview with the Prime Minister to discuss the mating of caterpillars.

To conclude, I am wondering if Mr. Szigeti would rise to a challenge and share a performance of one of the major concertos with full orchestra - say the Beethoven or Brahms - with a large audience present, he playing one of his old Italians and another player nominated by myself playing one of my instruments, and let the audience be the judges as to the superiority of this instrument or that -- this would be the kind of proof of the pudding of which Mr. Szigeti seems to be very fond - I wonder? Finally, he should be very much obliged to bow down a little to the world of visionaries, because they are without doubt, the creators of the violin, viola, 'cello, and again other crackpots have preserved them for posterity, and lastly, the modern crackpots have provided Mr. Szigeti with a lifetime of amusement!!!

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NOTICE

Owing to the fact that your Editor has been very ill for the last several weeks, this issue has been somewhat delayed. Also, we have been unable to answer the great pile of letters received. If some important letters are awaiting a reply, please write me again. Under the circumstances, no Certificates will be issued until next month.

We wish to thank the scores of friends who sent me such beautiful Christmas Greetings.

D. W.

The Adjusting of String Instruments

BY HENRY S. LITTLEBOY

Comments and Questions Welcomed.
Address communications to Mr. Henry Littleboy, 7 Sentry Hill Place, Corner of Pump Lane, Boston, Mass., U.S.A.

Soundpost Adjustment

The proper adjustment of the soundpost for members of the violin family has been the source of more "old wives tales" than any of the other adjustments. However, detailed discussions of the effects of moving the post with respect to the bridge are available in all the standard texts. What is lacking in almost all of them is the method of placing the post into the instrument, which is essential to the whole process. Since I feel strongly about this point, I will discuss it first and then review and comment on the other aspects of soundpost adjustment.

The point that I want to make is: YOU MUST REMOVE THE BRIDGE AND ENDPIN FROM THE INSTRUMENT BEFORE STARTING THE PROCESS. If this is not done you cannot put the post in the right place with both the right tension and absolute assurance that it is vertical. The top of the fiddle is lowered by several millimeters if the bridge and strings are allowed to remain on the instrument with the soundpost removed. Where a great deal of damage has been caused by the post gouging the top it is usually the fault of not removing the strings. So, remember, if you are setting the post or having the process performed for you, be certain that the strings are removed. The endpin must be removed so you can see that the post is absolutely vertical. Failure to perform these two operations guarantees a poor job of soundpost setting. Nothing done after this can correct for this oversight!

Since the operation most frequently required is resetting a post, let's discuss this first. I make it a practice to reset the post on every fiddle I am asked to adjust. As we discussed in the section on bridges, the variation in moisture content of the top which causes the swelling that affects string height also alters the soundpost tension to require adjustment. The comments that the fiddle doesn't have its usual power in the summer or is too "tight" sounding in the winter are directly attributable, in most cases, to the need for seasonal adjustment of the soundpost. I have found it desirable, in the case of several cellos, to have a summer and winter soundpost as well as the corresponding bridges for the proper adjustment of the instrument over the whole year. I recommend this adjustment, and assure the player that no damage to the top can occur if the precaution of removing the strings is observed. I also strongly oppose a player incessantly adjusting the post. Every player should be able to set his post in case of its accidentally falling, but the temptation to adjust constantly should be strongly discouraged! If the post is checked at six month intervals there is no need to fool with it. The rule (which applies also to checking string height) of looking at the post one month after turning on or off of the heating system is a good rule.

To reset the post, the tools required are a soundpost setter as illustrated in all the texts and also what is called the tweezer type of setter. The violin type of tweezer setter is perfectly adequate for use on cellos as well as violins and so only one size of this is available. In the following discussion I will identify the tweezer type as "tweezers" and call the other simply the "setter".

The first step (after removing strings and endpin) is to get the post out of the fiddle. The setter is used here to spear the post. The mark of the setter used in previously setting the post can be located and the sharp point of the setter carefully inserted and the post can be removed easily.

The setter is now inserted securely in the nick for it on the post and the post is carefully placed in a vertical position immediately behind the bridge with an allowance of about three millimeters for the violin and viola, and about five for the cello between the back of the bridge and the edge of the post nearest the bridge. Since the bridge is not on the instrument, the inner nicks of the "f" holes can be used as a guide. I usually touch the post to the back and then let it wedge gently against the top as I remove the setter. Here care must be taken not to mar the top.

Next, the post is viewed through the end pin hole and the tweezers are used through the "f" hole to make the post vertical. The tweezer can firmly hold the post and here is where the greatest skill is required to adjust the tension by a movement towards or away from the "f" hole while keeping it vertical. The post should be tight enough so that the instrument could be tapped lightly without having it fall but no feeling of really pulling on the tweezer is necessary in the final adjustment.

The endpin and strings are replaced and the fiddle

pulled up to pitch. If the tone is too harsh, the other end of the setter can be used to gently tap the post away from the bridge by about one millimeter towards the tailpiece. If other faults are found a new post is required for best adjustment. Damage to the top can be expected if more than this is done at this stage.

Now, if it seems that the post is not proper, the following steps should be performed.

The diameter of the post should be between five and six millimeters. A post should be replaced if it doesn't conform to these dimensions. Fine grained spruce should be used and can be purchased from any supply house. Cello soundposts are double the thickness of those for the violin.

The grain in the post should be at right angles to that of the top, when the soundpost is in position.

Since the material and diameter of the post are fixed and since the post must always be fitted to the top and back, the only thing that can be varied is the length of the post. Since we have a standard of tension, which has been discussed previously, it can be seen that varying the height varies the position of the post with respect to the "F" holes. Now we can use the general rule that the closer the post is to the "F" hole, the brighter is the sound of the upper strings. Therefore, when we do want to brighten the upper strings, we shorten the post and, if properly set, we will have accomplished our task. A new post when first cut should be set to fit properly when positioned directly behind the right foot of the bridge. Adjustment of the new post requires checking by playing and shortening until proper balance is achieved between higher and lower strings. If you are not a violinist and are unable to judge tonal quality, use this rule of thumb: the final place is usually two millimeters towards the "F" hole, for most fiddles, from the position behind the center of the right foot.

In conclusion, I suggest strongly that you follow the method described and your fiddle will show a great improvement in tone.

BOOK REVIEW
by
Clarence Cooper, Victoria, B. C.

CHLADNI FIGURES
A Study in Symmetry by Mary Desiree Waller
Published by G. Bell and Sons Limited, 1961. London.
Price: £2/2; XXii + 163 pp.

The late Dr. Waller produced in this book a picture book of musical notes in the form of patterns of symmetry by relating them to plain geometrical figures such as circles, ovals, triangles, squares, rectangles and rhombic forms. Her discovery that solid carbon dioxide applied to metal plates caused them to vibrate led her to explore the forms of symmetry produced by such vibrating plates. Her book is a collection of the pictures of the nodal patterns formed by the powder when solid carbon dioxide was applied to plates. The old method of bowing the edges of plates is not totally forgotten and its use is indicated where edge vibrations were required.

The book is divided into three parts in 47 groups of pages entitled "Plates". Each plate has illustrations of the experiments together with short explanatory notes. These notes are useful for the interpretation of the illustrations and found amongst the notes are certain rules enunciated from deductions made from the patterns. Each plate, consisting of several pages, is grouped according to the geometric form in Parts 1 and 2. Part 3 considers the phenomenon of the use of powder ridges in a sound field and miscellaneous other observations.

The book has a series of additional notes on miscellaneous facts. There is an interesting postscript referring to the law of symmetry of the two dimensional system. The book is completed by a name and reference index, followed by a general index.

On reading the book one will experience some difficulty in understanding the significance of some of the patterns. The written notes accompanying each plate are somewhat brief and quite frequently they refer to other technical works which are not all available to us.

The pictures of the patterns are, however, the most important feature of this book. These patterns are arranged according to the geometrical form of the metal plate used in the experiment and are placed in groups to demonstrate the increasing complexity of each pattern. Certain rules are mentioned relating to circular and diameter nodes. The comparison of the circular and ovular plates, as shown on Plates 12 and 13, are interesting when compared to Plate No. 4, showing circular plates together with an explanation of the patterns by nodal diameters and nodal circles referring to them as being in a two-vibrational system.

Plate No. 14 indicates that you can compare the nodal diameters and the nodal circles in ovular plates by relating them to the circular pattern.

An interesting feature of all the pictures is that more node lines for both the diameter nodes and the circular nodes appear as the vibration frequency increases. Another interesting feature is that the over-all patterns of diameter nodes and circular nodes appear in the various plates irrespective of their geometric form. However, in some of the rectangular plates one wonders if the vibrations are not travelling from one end to the other without following the rule.

Plate No. 12 contains in the explanatory notes the important tables of frequencies which may be useful for the adherent of the tap tones. If it is possible to obtain patterns when using tap tones they could be compared with the pictures in the book and the person could thereby obtain some conception of the vibration frequency of the piece being tested. The reason we suggest that the tables could be useful in this manner is because on examination of the pictures of Plate No. 12 it is indicated that in one group the axis of the oval plates are in relationship of 2-1; i.e., the octave relationship. Also, the second group of pictures of the oval plates indicate that the axis is as 5-4, which is the major third relationship. It will be recalled that the writer maintains that the rule as to the geometrical figure of the violin is based upon octave relationships in the length and the major third relationships in the width.

The form of node lines on violin plates appears in a recent article in the "Scientific American" of November, 1962, volume 207, No. 5, pp. 78-93, entitled "The Physics of Violins" by Carleen Maley Hutchins. On page 90 of the article is a series of pictures of the Chladni figures and the footnotes indicate the vibration frequencies of the plates. It is interesting to note that the figures formed on the plates obey the rules of symmetry referred to in Dr. Waller's book.

MY THEORIES REGARDING VIOLIN-MAKING

by E. H. Sangster
219 Preston Royal, Dallas, Texas

Much has been written and many theories scientific and otherwise have been propounded to account for wonderful tone quality of the instruments made by the Italians from Gaspare da Salo 1575 to J. B. Guadagnini 1775. Now let us examine and discuss the instruments made by all the makers during the two centuries, and see what we find.

First, they all know what to do, and did it to a greater or less degree to give their instruments that almost indescribable tone quality that is so pleasing. This shows that it was not any secret. Again, if we examine the instruments of all these makers we find almost every type of arching, high, flat, full, and otherwise, so the arching is not the answer.

The wood ... yes, the great majority used wood of fine quality ... tops straight-grained, fine, medium and open grain ... backs of plain maple, and highly flamed maple. However, we have wood today equally good ... so the wood is not the answer.

A word here about age improving the tone of an instrument. Yes, age does help somewhat in improving the tone and articulation of an instrument. Age makes wood more resonant. If we take a violin that is over one hundred years old and hold the back up to a bright light and look through the f hole you cannot see any light through the back ... but a new instrument shows light. (This is one way to tell the approximate age of a violin.) I might add here that experience has taught me that one can get good results using a top ten or twelve years old, but the back must be seasoned at least twenty-five years for best results.

It seems almost incredible that a method used by so many Italian violin makers over a period of two hundred years could suddenly be abandoned or lost ... yet there is one clue and the only one that I know of that is authentic, and it was written to Galileo in 1638 and it states that the violin cannot be brought to perfection without the strong heat of the sun. This clue has been overlooked by the great majority of makers during the last century, and is still not taken into account, yet experience has taught me that it is just as true today as it was in the seventeenth century. The violin cannot be brought to perfection without the strong heat of the sun!

Now, for what purpose or reason would those old Italian makers use the strong heat of the sun ... surely it was not to season the wood, because if they used unseasoned wood it would shrink and crack when put out in the sun. Therefore, they must have put something on the violin which they had to oxidize or dry before they varnished.

I have not been able to find any clue to what the Italians put on their instruments and oxidized before they varnished. However, from information gathered from other sources and experience has led me to believe that pure raw linseed oil was what the Italians used. Also, it is the only thing that I know of that will allow me to make a violin as thin in thickness as Stradivari. (Back 10/64ths in center and 6/64ths at the purfling. Top 6/64ths all over.) A word of warning to anyone who wishes to use linseed oil. Do not expect to varnish in less than six months. A violin on which oil has been applied must be oxidized in the direct rays of the sun for at least three months or longer before varnishing.

About varnish - Many writers in the past would have us believe that the varnish used by the old Italians gave their instruments the wonderful tone. Nothing could be more foolish. The color varnish they used had nothing to do with the tone. I have seen several Stradivari violins with one-third of the color varnish worn off but it did not affect their tone ... but I would like to point out that where the color varnish is worn off the back of most any old Italian violin there is no raw wood ... the wood is highly polished, and my experience tells me there is only one thing which will give this effect, and that is raw linseed oil. Any kind of wood can be given a wonderful finish by using raw linseed oil, sunlight, time, and hard work!

Many modern makers are now using science to solve the method of the old Italians. I cannot agree with the idea that tuning the plates will produce the perfect violin, and my belief is based on the fact that the violas of Gasparo da Salo made 150 years before Stradivari and still the finest ever produced. If Gasparo had used a system of tuning the plates, putting in a larger bass bar would certainly have upset the tuning of his plates as the larger the bar the higher the tone of the plate.

Also, I will venture that a maker can make ten violins using the microtone system and when they are all finished he will find that two of them will stand out above the other eight in tone and articulation .. and he will not know why.

Violin-making is a wonderful hobby, but as a means of making a living it is nil. Experience has taught me that it is impossible for a maker to make a new instrument, however good, play like a fine instrument that has been played even ten years. It is rare that you will find a professional violinist that will buy and play on a new violin, especially if he has a good old one that has been played on for a term of years.

During the last twelve years I have had excellent results using pure raw linseed oil as a filler. It requires time, sunlight and patience ... but the benefit in tone quality and articulation is much improved by allowing one to make the plates a bit thinner. This can be easily proven by taking a piece of soft cloth and coat it with pure raw linseed oil, put it out in the sunlight for six weeks; it will be very stiff ... the same way that starch makes the collar of your shirt stiff.

From the fact that we have wood equally good and that there have been thousands and thousands of exact copies of Strad and Guarneri made by makers all over the world that have not proven equal to the old Italians points to me that the old Italians must have used a method or have done something that later makers did not do.

I am not writing this to tell makers how a violin should be made ... but only for the record. If the violins I am making prove to be equal to the very best, then future makers will know the method I used. (Please note the big "If")!!

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Regarding Correspondence to the Editor

It would be appreciated if mail pertaining to business only, be sent in at the present time.

If you have forwarded letters which to date have not been answered owing to the Editor's illness, please send them in again in a week's time.

The String Section

Conducted by
CARMEN WHITE

A SIMILAR EXPERIENCE TO MR. WM. SLABY

by Frank Paine
Johnsville, N. Y.

At this time I should like to comment on the article by Mr. Slaby regarding his "find" of a fine old fiddle. His experience is so parallel to my own that I may be able to give him the benefit of what I have discovered.

About two years ago, a teen-age neighbor of mine walked into my studio and showed me a violin that had been laying in her cellar for twelve years. She wanted me to put it in playing shape so that she might take lessons. Money was important, so could I give an estimate. After giving my estimate of the cost, and while awaiting her reply, I took a closer look at the instrument. It was the most beautiful Strad copy I have ever seen, except for the varnish, which was brown over yellow. The neck was off, so I could not string it up to play. I made a quick decision, and when the girl's father came to see me that night with the hope that I could cut my price, I told him that I had already quoted a rock bottom figure, but would give him a new violin outfit in exchange for the old violin. I believe in absolute honesty in these things, so I told him that I would have either a fine old violin, or a piece of junk, and at that time I could not tell which. We made the deal, and I went to work on my "masterpiece".

After much cleaning, I uncovered a label. It revealed the maker as Franciscus Geissenhof, and the instrument was made in Vienna in 1804. At the time, the name was not familiar to me, but I have found he was a pupil of Mathias Thir, and took over the business when Thir retired. The instrument has been declared genuine by a friend of mind who formerly taught violin making in Germany, and who is now a prosperous importer of violins. The Strad model, which Geissenhof adopted in about 1800, is listed in authoritative books at about $850 considerably more than his teacher's. Unlike Mr. Slaby, I started with a known quality, but many times doubted the books I read about Mr. Geissenhof and his violins.

First allow me to comment on the block between the neck and the body of the instrument. My Geissenhof also has a block in the same place, in addition to one about 1/8" between the neck and the button. My informant tells me that this was conventional construction in those days, and I have been reluctant to change it. I would advise Mr. Slaby to carefully examine his violin for traces of the original varnish on the block. It may have been put there by the maker.

Now about the instrument itself. Horrible, raucous, tinny. Those are the only words that can describe this violin. I had made a deal, so I had to play on it. After two or three patient months, I began to hear a promise of tone. It was the most temperamental thing I have ever encountered. Every slight change in the weather affected the sound. Finally, after a year of abusing my ears, during which time I had made every alteration possible, the good days outnumbered the bad ones. Now, after nearly two years, my Geissenhof is my constant companion. It has a beautiful, even tone, is responsive, and has tremendous carrying power. Truly a professional violin.

If Mr. Slaby would accept some advice, I would suggest that he try the violin in a large place (as suggested by Mr. Carmen White in an article several months ago). Too few violins are tested in this manner, and poor evaluation results. The place for testing should be an auditorium of <u>not</u> less than 1000 seats. The first test should be for carrying power, and next for tone <u>at a distance.</u> Forget how it sounds under the ear, this will change with playing. Don't give up the ship, Mr. Slaby, your first judgment may be right, only time will tell.

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MY METHOD OF TUNING PLATES

by Robert F. McGowan

For the past five years, or since I mastered the tools of the luthier enough to make a respectable looking violin, I have been experimenting with toning the violin in the white. I have had to retrace my steps several times after being led far afield by following a wrong theory, and I must confess that I have spoiled several violins, to determine how far one could go before passing the point of no return to good tone. In my own defense let me say this, the violins were mine, and the time spent cannot be considered to be wasted because I have discovered a great many things that don't work. However, from all this hobby room research several facts have emerged. Toning of the plates by testing as the plate thickness is reduced has given such excellent and exciting results that I feel I must share my findings so that other more qualified makers and players may carry on and perfect this extraordinary method.

In order to explain this method I must deal with elementary tone production, and I am quite sure the purists and acoustics experts will gasp in horror at my heresy when I depart from known facts. Since the best physicists with all the latest electronic equipment have failed to discover the many secrets of the violin, I trust these learned men will be as generous as M. Voltaire who once said to a colleague, "I disagree with everything you say Monsieur, but I will defend with my life, your right to say it."

There is in every violin a critical point in the adjustment of the plate thickness. Because we are dealing with wood, an unknown factor, no two violins can have the same thickness when properly thinned to cause the body of the instrument to act as a suitable resonator. This fact has been known for years and is the most important factor in violin tone, yet most writers hurdle this barrier with a statement such as, "He seemed to vary his thicknesses according to the acoustical properties of the wood." They then hurry on to state that the superior tone was perhaps because of the perfect climate of Italy, or some other vague or ridiculous theory. If one asks how and why, did the old luthiers vary these dimensions in each instrument, it takes us back to the workbenches of Cremona in the year 1760. Hard times were coming to Europe, the violin could and would be produced cheaper. Short cuts in methods of construction were used and have been improved down to the present time with the net result that the modern violin can be purchased for $200.00 and the old ones if good are sacrificed for a paltry $50,000.00

Let us go back then and take another path. I think you will find it interesting. For this experiment you may make a new violin, purchase a factory violin in the white, or remove the varnish from a dud violin if enough wood remains. If you make a new violin, I strongly urge that plain maple be used, both for cost since this is an experiment and the plain wood is easier to tone. Since the only tool required is the scraper, here is fun for all, maker, repairman and fiddler.

There is one fault in the modern violin which must be corrected if you are to get the best results. In most drawings the draftsman has wandered far from the archings of Cremona. This fault is found most often in the top arching near the Fs, and most important, in the long centre line arch. Examine a Strad and you will notice that while the long arch of the back is nearly perfect, the top has a slight near flatness near the bridge, then slowly fairs off the more pronounced arching. In the early violins this flatness is more pronounced. As Strad improved the Grand Model this centre line of the top approached the true arch but the slight flattening is still there. The copyists and draftsmen have improved this line until it has disappeared completely. The Amati top arching produces a sweeter tone and is easy to adjust, but lacks reserve power. The nearer this centre line approaches a true arch the more reserve power and brilliancy it has, but the top will be difficult to adjust without magnifying inherent faults. This most important fact must be kept in mind and still applies no matter what system of graduation is followed. It took the old masters years to change this top arch and learn to adjust it, so go carefully here, this area near the bridge is where the tone quality is decided and the tension on this slight curve is all important.

Let us start with a violin ready for the final adjustment of the thickness of top and back before fitting the bar and final assembly. The top should be between 2.7mm and 3.2mm, depending of course on the type of wood used. It can be even all over with this exception, in the waist, near the end blocks and the inner edges of the Fs the wood must be left thicker. A slight rise in these thicknesses to obtain a perfect inner arch is a must. To gouge out wood near the blocks and Cs to maintain an even thickness at the linings will ruin the top. The old Italian violins show this same rise in thickness at the blocks and Cs even though they are said to be even all over. If the top is of stiff vigorous wood and can be thinned to 2.7, fit it with a fine grained stiff bass bar rather

on the light side. If soft open grained wood is used, use similar wood and make the bar of standard or slightly larger dimensions. When all is ready, finish the lower wing tips of the Fs near the Cs with the Italian fluting or curve so they are somewhat thinner than before. Do not thin the wood at the lower curves of the Fs.

Make the back of standard dimensions but add .5 or .75mm to the original thickness for removal later. The wood will determine the thickness here as in the top, if you have your own tap tone system for this, fine, but err on the heavy side since you will remove wood after assembly. The wood must be left thicker in the waist at the linings. Do not thin the back to minimum near the neck block, but slowly fair this thickness to the over all thickness at the centre line. The upper and lower parts of the back at the bouts can be thinned slightly but will rise from 2.5mm to 3.0 at the linings. In the waist the drop will be constant, say from 5.0mm at the centre of the back to 3.2mm at the linings near the Cs. You will note that the top and back differ in that the drop to the linings is reversed.

Since we are to finish the graduation after assembly the fingerboard will have to be fitted so we can work under it. Make a short temporary fingerboard from an old one and thin the underside from the neck line to admit a scraper after fitting. (See the cover on the Feb.-March Journal for a look at one of the original fingerboards.) Assemble the instrument and let it season for a week so the wood may adjust to the strain of clamping. The sun is fine for this.

Use a good set of strings and fit a standard bridge of good quality. Do not try to save money here, and above all use wound gut strings only. If you insist on using wire or rope strings this is not for you and will only result in wasted time and material. I never saw metal strings (E excepted) on a master violin, and any violin which sounds loud and raucous under the ear has very little power. Fit a good soundpost of proven wood so that it is 3.0 to 3.5mm back of the bridge line (rear face) and the same distance from the edge of the F as is the bar on the opposite side. It must be perfectly fitted to both top and back, and with just enough length so that it will stay in position with no tension on any of the strings.

If the weather is dry, bring the violin up to pitch, play it using a heavy bow until the stretch is out of the strings and the wood has adjusted to the new strain. (no more sunning now.) Now you will have to decide what kind of a voice the instrument has. It will be stiff and unresponsive but it can be heard if you listen for it. This is the natural voicing and is determined by the characteristics of the wood used in the top and back and cannot be changed. What we want to improve is the quality. There will be a crisp wooden quality because of no primer or varnish. Disregard this and concentrate on peaking up the resonance throughout the whole range of the instrument.

Grind, edge, and hone two scrapers (described at end of this article), a left and a right which can be entered under most of the fingerboard and tailpiece. You will not be able to get under all of a standard tailpiece, but no matter, it is not important. With long sure strokes take one complete cut from the whole surface of the top starting at the feet of the bridge forward to the upper bouts, then from the bridge to the lower bouts. Don't take little mouse nibbles, but take an even shaving with a long curved stroke from the feet of the bridge to the purfling. Have a slight curve on the scraper edge so these cuts will be quite distinct. Now tune the instrument and test. If the tone seems to be even on all strings, turn the instrument over and take a cut from the back, tune and test again. If the violin is hard to play keep taking additional cuts from the top until it plays easier (careful here) and begins to produce near perfect fifths. As you continue carefully you will notice that suddenly the violin will take on a different tone, rich, vibrant, and full. The tone will seem to be outside the instrument and will fill the room. This usually shows first on the A and D strings. If the G is stubborn and dry especially on the note B, and the E string has a metallic quality, fine, you are on the right path. Tread carefully. Now we come to the point where we must depart from usual practice and theory. The lower notes of the violin are controlled by the tension of the back, which is more important than the top in producing that pulsing, throbbing resonance so admired in a master violin. The intensity of the higher range is controlled by the mass of wood under the post and the waist. Now take one complete cut from the back and test again. What we are trying to do is bring the two diaphrams, the top and the back into phase, and since you started with a 5.0mm at the centre of the back reduced to a 2.8 in the thinnest part, there is bound to be a point where, as we remove wood the back becomes a perfect soundboard when activated by the soundpost and is intensified by the contained air of the instrument. When this point of near maximum resonance is reached the violin will take on a clarinet like quality, the trick is to control this down through the lower range to open G. Thinning the back in the upper and lower bouts seems to produce this effect.

When the violin begins to take on this quality you must proceed carefully or you can pass the point of good tone. Loosen the strings and remove the tail piece and post. Check the soundpost for length. As you remove wood the stress points will change and the post must be adjusted to the correct length. During the adjustment of thicknesses the post length is the most important factor. If too long, too much wood will be removed from the top, and if too short the stress points will shift about as the plates are reduced. I spoiled a violin before I discovered the importance of the post length.

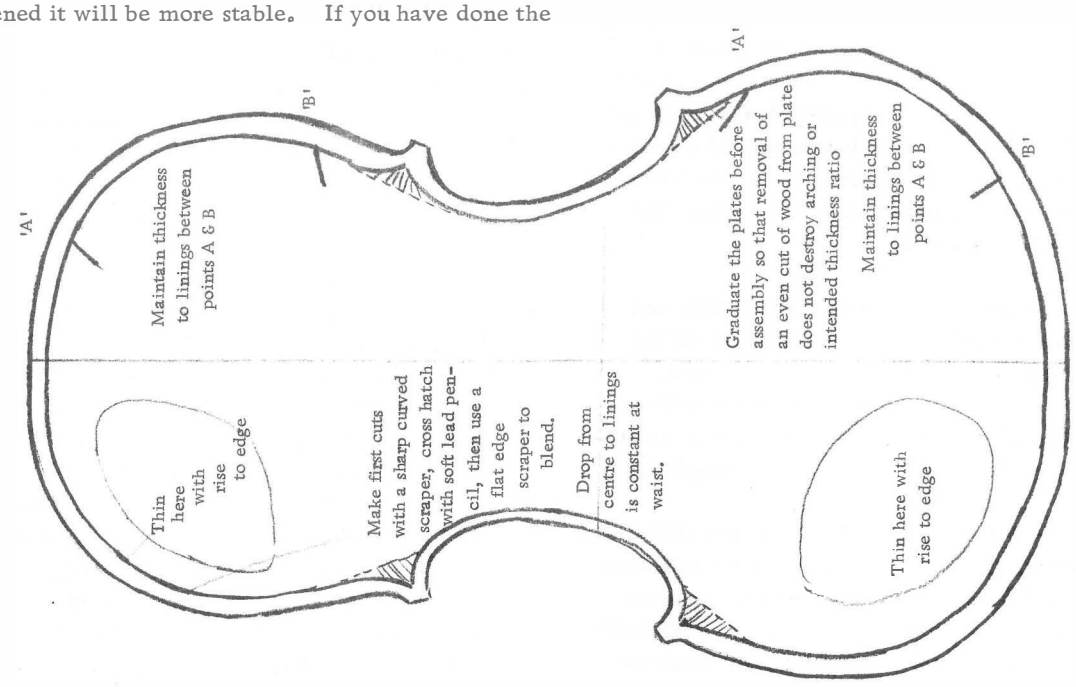
With the strings away from the top, (wrap the whole assembly around the scroll) take one finish cut with a flat scraper, smooth out the top under the bridge with fine sandpaper glued to a flexible flat stick, fit bridge, strings and post and bring up to pitch.

By now you will have discovered that the tone comes up to near peak and then leaves when more wood is removed from the top, but returns more full and powerful when the back is thinned. This alternate phasing of the plates can be continued until fullness is replaced by coarseness and wolf notes appear. (I have purposely gone too far to test this) I am not a violinist but I think the best results can be obtained by testing with alternate heavy and light bowing until near maximum resonance is reached and then stopping. As you proceed with this alternate thinning of the plates, make sure that each cut is smooth and even and will take very little scraping to finish. You will be tempted to carry this too far, but it is better to stop before too much wood is removed, so make each cut as though it were to be the final one, it may well be.

Now a word of warning. When you have finished toning, don't leave tension on the strings. If you do, moisture from the atmosphere will settle the new wood and the tone will suffer. If you want to test later, fine but check the post and bring up to pitch each time. New wood will not stand a steady pressure without warping, after being primed and hardened it will be more stable. If you have done the scraping carefully, from here on is routine final finish, priming and varnish. You will get no better results than your ear can give you, and if you have a violinist friend to help you so much the better. The finish will dampen and improve the quality.

What to use for filler and varnish? I wish I knew. The English seem to excel in violin finishing. If you are sure your own private concoction is the best by all means use it. If you know where the real Cremona filler and varnish can be obtained, wait, and I'll go with you.

If you are of the linseed oil school fine, but make sure that only pure linseed oil is used. The old linseed oil was taken from the crushed seed of the flax by pressing, with the result that much of the oil could not be extracted from the fibers under pressure. Modern methods use superheated steam and then separate the oils centrifugally. The valuable resins are lost by this method and then cottonseed and other oils are added. This adulterated mess can be boiled until doomsday without adding to its drying properties. Applied to raw wood it will drink water like a sponge and never dries. Reade was quite right when he spoke of the 'sinful practices of commerce'. I am quite sure that the profit on this unholy mess will take away one's breath as well as a sniff of the mixture! Use artist grade oils if you must, and use sparingly.



DISCUSSION: Whether or not the old masters used this system will never be known, but the short fingerboard fitted before varnishing, easy access to the top near the bridge, thick and thin spots found in the plates and faint scraper marks seen on the backs of the old violins make it a point worthy of consideration.

It cannot be disputed that both Strad and Del Gesu sent their many creations forth with a distinctive tonal quality, and though each maker's concept of proper violin tone differed, those surviving examples, under the hand of the concert violinist still proclaim most proudly, "This is how my maker thought I should sing." The millions of

copies made since refute the theory that the secret is slavish duplication. Violin making is an art and must remain so. The maker who falls into formula concretes his mind and is beaten before he starts.

The baroque design of the violin body, the many other variable dimensions, and last but most important, the wood combinations, indicate that a final adjustment of the plates after stringing up is a very simple and logical approach to the problem. Properly done, it takes much of the guesswork out of violin making.

A set of inside calipers is useful if you are worried about thick and thin spots showing up in the finished work, but if you ever caliper a Cremona you will soon be rid of the notion that an even reduction in thickness is the answer to good tone. I made a violin and used them in the white toning method. It was an excellent violin, after two coats of primer I removed the top and blended the thicknesses a la textbook. After assembly the measurements were perfect, but the tone was gone. Maximum wood removed in spots was 1/2 MM.

It could be that the secret of good tone lies in these slight imperfections. If Del Gesu or even Stradivari could return today, make a violin and submit it to the experts for an opinion, they would be laughed at for the crude work and imperfect detail. After the tone tests were complete the laughter would not be very loud.

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Additional Information

The following is not to be included in the main article. It only indicates experiments I have been following, not yet confirmed, those makers wishful of continuing my investigation could perhaps continue along these lines.

In all this salad of claims, methods of graduating, priming, air space and all there are some facts which cannot be disputed. Here is a fact that I have stumbled upon, and I'll bet my poke it's true.

When a violin has been completed in the white as carefully as possible it may or may not be a good instrument when played in the white. Age, playing in, filler, varnish, bridge and post adjustment will not change this and age will only make it worse.

There is in every violin something of beauty and tonal expression if it can be brought out by adjusting the thickness of the plates to take advantage of the wood, arching and model. The voice of the instrument is determined by the wood and cannot be changed. It will still be the same to a certain degree no matter what changes are made.

There is in every violin a critical point in the adjustment of these tensions and thickness of the plates and since wood will differ in strength and density even in the same block no standard set of dimensions can be given. This will result in the occasional mistake or accident which occurs when for some unknown reason a violin will be outstanding, and later ones from the same wood and form will be poor or average.

This accident if it can be called such can be made to occur most of the time by thinning the plates and testing as the wood is removed.

The tone will come and I might add disappear like a ship in the night if too much top wood is removed. But here is the most exciting and interesting thing, if the back is reduced after the tone starts to get weaker it will return fuller than before but darker. (This adjusting of balances can be carried on until the wood is so thin that coarseness takes the place of fullness of tone and wolf notes appear. I have purposely gone too far to test this extraordinary occurrence, knowing that I was spoiling the violin.)

The tone will be at its best when the top is thinned so that the violin is even and responsive from the high range to open G and then the back must be thinned so that it is in phase with, but is supplementary to the top. Mr. Skou describes this perfectly when he says the top must master the back, and Mr. Sanborn's description of the plates being in phase throughout the entire range by his method of increasing or cancelling the motion of a pendulum by the timing of an added impetus or push at the end of each cycle or motion. Such as pushing a child in a swing. The ideal condition would be a balance which would augment the tone throughout the whole range of the violin. This is of course impossible but the closer an instrument reaches this ideal the better it is. The few existing Cremonas today approach this ideal. (the famous few)

Whether the top will be thick in the centre and thin to the edge or the other way around seems to depend on the grain of the wood and the arching. If the top is fine grained in the centre and wide to the edges they seem to want to be

thinned to even thickness or slightly thinned under the bridge. This will depend on the long arch at the center-line however. You will notice that the early violins were somewhat flat near the bridge and left thicker in the wood there. (Amati). Strad shows a slight flattening near the bridge and while I have not proven this completely, I would say that the long arch will determine to a great deal the thickness of the top under the bridge depending of course on the grain and density of the wood. This however is a fact, the flatter Amati arch is easier to adjust for tone, and the nearer this curve approaches a true arch the tougher it is to adjust by thinning but the greater the volume and reserve when properly thinned near the bridge.

Some tops respond better when thinner at the edges, and others when even or slightly thinner under the bridge. If an even top does not respond in the lower range I thin slightly in the upper and lower parts to the lining. Also, it seems that a violin top which is slightly thinner on the bass bar side is more responsive and full, but I will not be guilty of making this opinion public because I may be wrong. The grain of the wood also will determine whether or not the top is even all over, thick under the bridge or the other way around. At any rate, if the even top is used the results are good when adjusted, as I have outlined, with the back, and the results can be on the safe side. W ithout expensive inside calipers it is quite a trick to maintain an even drop or rise in thickness after assembly. This phasing, or adjustment of tension and wgts will work and give results, the maker may take it from there.

I can say without reservation that that one of the most thrilling and exciting moments for a maker is that time when after the violin is completed and the final toning is started to hear this warm, reedy, powerful tone begin to show. It seems to have a peculiar bite to it which is quite distinct on the D string. As the wood is removed to the edge the G will seem to have a dry effect which will improve to a richer, fuller tone as the wood is thinned in the upper and lower bouts. (This thinning must not be carried out in the waist or near the end blocks or the reserve and brilliancy will suffer.)

This is in no sense an instruction sheet for toning, only to give you an idea of the many things which must be considered if the work is to be done properly. There is much more to be done, so many things unanswered. I have at this time seven violins which I have used for this experiment and some I have spoiled to determine what is good and what is not. An old violin can be stripped of its varnish and used for this work (I have used four) but the end result seems to be poorer than when new wood is used. It may be that the old filler, and years of tension have changed the wood too much. I have also had better results when the work was done quite quickly (2 hours) and then unstrung, than by spacing the work over days or weeks. When the job is finished, primed and varnished it seems to retain all of its tone and improve daily especially in the upper positions and responsiveness.

I have tried to keep from making wild claims because I see too many misleading articles. I will say again that if the violin is well made of good materials, this final adjustment will make an excellent violin every time. I tried to apply the tap tone method to determine if certain tone intervals could be set up before assembly to make the final toning easy but the results were not conclusive.

If my work can be taken over by other makers and notes kept of tone interval, air tone, and final results recorded much good will come of it. At any rate, this final adjustment is the only way I know of taking the guesswork out of violin making.

Perhaps you have noticed that in the common run of violins some Strad copies will have the brilliant Guarneri tone, and the Guarneri model will have the reedy Strad quality. I have used this final adjustment on both models and can make this statement. If the model is accurate as to arching and initial plate thickness, if the Strad has a bit less wood than the Guarneri especially in the back, when the instruments are peaked up to maximum resonance there will be no doubt to the listener which violin is being played. This may not be of any help to you but here is what I listen for when I start the final scraping.

1. Listen for that point at which the instrument becomes an 'air' instrument instead of a stringed instrument.
2. Before this starts the tone will begin to show a 'bite' when the stroke is started. (First on A and D.)
3. When the plates are in phase the tone will be soft and melting like the voice of an Italian singer.
4. When adjusted properly the tone will seem to be outside the violin.
5. The Guarneri model seems to require a biting bow, the Strad responds better with a ligher bow pressure.

That is about all I can tell you, about the rest I don't know. I have many pet theories of course, no doubt most of them are wrong.

My wife brought home from the public library today the November issue of the Scientific American. There was a very interesting article by Carleen Hutchins "The Physics of Violins". I scanned it briefly but what it adds up to after pages of acoustics tests is that the plates are removed and thinned several times after assembly to make the instrument respond. After all the testing and tapping before assembly, and all the fine electronic instruments are used, the plates still have to be removed and thinned until the instrument responds! Why not remove the wood from the outside Carleen ????

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