MODEL OF PRODUCTIVE PROCESS

FUJARA

VIOLIN

Document elaborated as a contribution to the transnational project „HANDYPRISE“

Európsky sociálny fond

CHAPTER 1
PRODUCTIVE PROCESS OF FUJARA - overtone bass flute

1.1 DESCRIPTION

Fujara is about five and half feet (165 – 190 cm) long flageolet style fipple flute, hand made from wood of upland deciduous trees. Diameter of wooden tube is 3-5 cm with three holes in the lower part. The air is transported by a smaller wooden pipe of 50 - 70 cm tied to the large tube.
It is deep-bass folk flute of Slovak shepherds flute and one cannot find similar anywhere but in Slovakia. It is a typical Slovak folk instrument whose native home is a small region in central Slovakia called Podpoľanie.
Cherished in the seclusion of Slovakian mountains, Fujara preserved over centuries as simple as it was in the beginning. Fujara flute uniquely combines a natural, easy to learn playing technique and an amazing voice.
At the same time, every Fujara flute is a unique creative work of art - an original.

It first appeared in the 10th century, but the oldest fujaras preserved are from the second half of the 19th century only.

1.2 MATERIAL

Traditionally, The material used for the building of the instrument is from semi-hard wood of deciduous trees (elder / elderberry - *Sambucus nigra*, maple - *Acer*, locust tree – *Robinia pseudoacacia*), and it takes up to one month to build a good Fujara from a seasoned piece of upland wood.

Elder – *Sambucus nigra*

Wood of Maple – *Acer* (see also annex)

Locust tree – *Robinia pseudoacacia*   Wood of locust tree

The choice of the wood, its storage (two to three years), treatment and decoration require a great deal of care. Each instrument is completely hand-made and individually finished and hence production is limited.

1.3 PLAYING

Fujara can be best described as solo overtone flute in bass position**.** As the Fujara has 3 fingering holes (vents) only, but the height of tone is decided mainly by the strength of in-blown air creating thus various overtones**.** Fujara can play easily in 7 harmonic / overtone "levels" **(**all fingering holes closed) purely by over blowing. That also means one can play simple melodies by over-blowing only. Moreover, in combination with simple fingering technique, Fujara flute can play more than 21 various notes in the range of more than 3 octaves**.** Half shading and subtle breath variations give even more possibilities.
Fujara flute is designed to play high up into the overtone series as well as in the lowest bass series with a soft haunting voice. That involves shriller tones by playing "scatter" on the beginning of the song and "whoosh" by overblowing the instrument.

The tone is produced by a labium with an inserted block and a cleft. The sound is produced by a fipple on the upper end of the main body of the fujara. The air is led to the fipple by a smaller parallel pipe, called a "vzduchovod" (Slovak for "air channel"), mounted on the main body of the instrument. This smaller parallel pipe enables the player to reach the three tone holes. The fujara is played standing, with the instrument held vertically, braced usually against the right thigh.
The atypical design provides for a deep, meditative timbre. Ornaments are traditionally added to the base melodies, which usually occur in the mixolydian mode. Two common types of ornaments are “prefuk” (a rapid overblow of one note, from the Slovak prefukovať, to overblow) and “rozfuk” (a descending cascade of overtones, from the Slovak rozfúkať, to scatter).

Fujara melodies are mixolydic, melancholic, with radiantly strident sound clusters. The fujara is commonly played as a solo instrument but also in groups of three to seven, sometimes also with a lead singer. Some contemporary written music for fujara even makes use of string orchestras.

Fujara's beautiful overtones sounding in perfect harmony with the player's breath can give very satisfactory meditative feeling even for the very beginner and make the learning process fun, interesting and thus easy. Fujara's unique breathing-like playing technique leads to improvisation.

1.4 PRODUCTIVE PROCESS

1.4.1 TOOLS AND MATERIAL

Rough processing

1. augers
2. two-handed knife
3. handsaw
4. medium-sized plane
5. small „hobby“ plane
6. tape measure
7. woodcarver’s knife
8. flat chisel (from 6 to 10 mm)
9. drill
10. auger (from 4,5 to 10 mm)
11. needle rasp / file
12. cork stopper
13. tuner (for sound)

Surface treatment

14. rasp
15. sandpaper (granularity – 60, 80, 120, 180, 220, 360, 1200)
16. piece of glass or sheet
17. stain of walnut rind
18. flax or paraffin oil
19. lac
20. denaturized spirit
21. clean flax or cotton rag
22. leather band (width 5 mm, thickness 2 - 3 mm, length 1 m)

1.4.2 STEPS OF PRODUCTIVE PROCESS

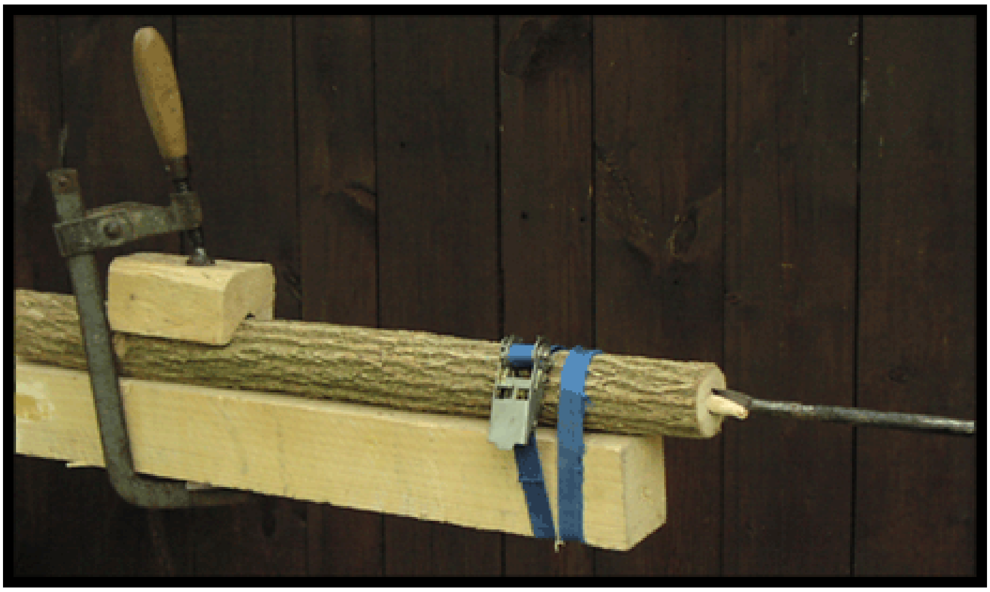
1. Drying and drilling of wood
2. Debarking and rough processing
3. Tone-making device
4. Basic tune up
5. Air channel (smaller wooden pipe)
6. Making of side tactual gaps (vents) and final tune up

(See also picture in annex – *Construction parts of fujara*)

1.4.2.1 Drying and drilling of wood

Before starting making fujara, we need properly dry wood. It means that material have to be store immediately if we do not need it for other purposes, e.g. pre–drilling. If drying wood at home we need to pre–drill the wood; diam of drill is half a diam of final drilling. We put wood to the joiner's bench and fix securely (picture 1 and 2). After drilling we paint over both ends of wood. We leave it to dry for one month in the place with non changing climatic condition. From the beginning wood can stay outside to prevent fast drying which caused crevices. After month we take off part of the bark and we leave it to dry again. Wood for the fujara is appropriate after half a year, but “what longer that better”. When wood is dry, we drill it; diam of drill is half a diam of final drilling. For pre-drilling we use drill diam 16 mm and for final drilling drill diam 24 mm (picture 3). If wood is bent we use tool to straighten and fix of the wood. The tool is letter „V“ shape in which we put wood and fix it up. After that we can start straighten it carefully.

Picture 1



Picture 2

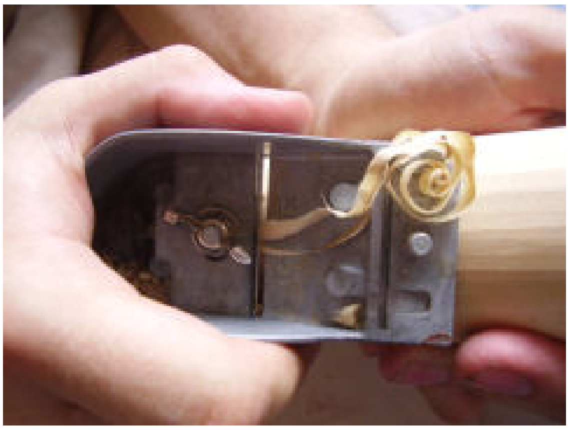
Picture 3

1.4.4.2 Debarking and rough processing

After drilling, we take off the bark (picture 4). We can use also two-handed knife. To get needed diameter we use pencil to mark it first and than we shape it by „hobby“ plane. We plane off thicker pieces by medium-sized plane. It is important to think about surfeit and also not forget to plane material. As first, we plane a part for tone-making device (picture 5, 6, 7, 8).

Picture 4






Picture 5, 6, 7, 8

1.4.2.3 Tone-making device

It is just tone-making device which has the biggest influence on quality and color of tone (hence the name of the device).

Picture 9

As first we have to make a mark with pencil, where hole (small window) will be situated (picture 9). The place of window we define by following calculation:

- measure of drill diameter
- divide this measure by 2 and add 10 mm

- mark out this length on the instrument axis (which was indicated before); e.g. 24 mm (drill diameter) x 2 + 10 mm = 58 mm
- above mentioned length / measure is distance between an edge of material and upper part of hole

If material is bending a bit, we place the hole on a concave part of material. Then draw small square at this point since it will be mark for border of the hole. Then we mark the border of groove (flue, vent) by chisel (picture 10). The hole should be 1 mm shorter then his width.

Picture 10

Picture 11

After precise shaping (working out) we could continue in a groove deepen. Groove is deepening equally until it is not under the level of the hole. Lower part of hole we level to plain surface. Here we make edge with thickness of about 1 – 1, 5 mm. Just at this place are tones created and air column make frequencies of by us designed tone. We could grind all the imperfections with needle rasps. (picture 11)

After this part we start to make wedge (small chock) which has to be accurate since it could fall out. Wedge is made from hazel (Corylus avellana). We put the wedge in the material and mark edges of the groove. Marked edges on hazel are leveled with 10 mm chisel. We put in the wedge to the material again and try to blow into wood and analyze the sound. It is common that appropriate sound is not appearing for a first time. We could try to gently abrade the hole.

1.4.2.4 Basic tune up

All the wind instruments are tune up by truncating. If the hole is made properly, it creates nice and clear tone. We can deal with basic tune up. Basic tune up is when an instrument plays a tone, which is the most often situated (occurred) in octaves. We blow into the instrument and set up basic tone by tuning fork. If the instrument plays more tones or plays some tone not clear we need to truncate him with a saw. We have to remember that by continuously truncating the instrument play higher tones. After tune up the basic tone we can make "vzduchovod" - *Slovak for "air channel"*.

1.4.2.5 Air channel (smaller wooden pipe)

Air channel makes play on fujara easier and allows us propriety tune up the instrument.
It is made from elder too. The length of this part is one third from total length of fujara. We need to debarking elder and drill it with 10 mm auger. On the opposite side of hole we mark a point in the distance about 15 mm from upper edge of the instrument. Then we drill this point with 9 mm auger and pass through the wedge too. (picture 12). We do the same on air channel. One hole is placed at point where air channel is put on drilled part of main body of the instrument to aggregate these two parts with join "icicle". Second hole is drilled about 80 mm from lower edge of fujara. We have to plug up both ends with cork.

Picture 12

Icicle is made from small pieces of elder with length 30 – 40 mm. Icicle is drilled with 6 mm auger and abraded. This piece is inserted to main body and smaller parallel pipe – air channel is mounted on it. We insert leather wedge to the air gap and blow into pipe tube in order to check if the air do not escape of somewhere.

1.4.2.6 Making of side tactual holes (vents) and final tune-up

When we tune-up the instrument to basic tone we can start to drill side tactual holes. Since all other tones base on this basic tone it is very important to keep dimension of fujara's individual parts.

Productive process of side tactual holes is following:

- we need to measure total length of fujara's main tube
- divided this length by 14
- 1/14 of total length is one unit (as measure) which is mark out on main tube axis

$$\frac{L}{14} = 1 \text{ unit}$$

L – total length of instrument

Process of unit mark out is following:

1. we mark a measure (equal to diameter of fujara's drilled hole) on tube axis from lower side
2. from this point (described above) we mark out 4 units as points
3. first tactual hole fall on the third point
4. second tactual hole fall on the fourth point, but we shift him by a half of diameter of drilled hole
5. third tactual hole fall on the fifth point

We drill marked points with 6 mm auger since beginning and to test the tune-up of the instrument after each drill. Fujara has to phonate tones derived from basic tone, e.g. tune-up in C has to follow by tones D, E, F, G, A, H, C. It is necessary to strongly pay attention and be very precise in this phase of process – tune-up of individual tones! After each enlarging of tactual holes we need to remove small spills. Needle rasps are used for this operation. Interior (core) of tube is cleaned with sandpaper fixed on some stick. Significant influence on clarity of tune-up and purity of tone has also thickness of wall in the place of tactual hole.

At the end of final tune-up we try to play (musical) scale or some melody and test the tune of the instrument again. It is the last operation where we adjust acoustic quality of the instrument.

1.4.3 SURFACE TREATMENT

Surface treatment involves not only varnishing, but also abrasion to the acquired graininess.
We start to shape overall look with a plane. Then we need to adjust both ends upright to the axis of tube. This adjustment is made by abrasive disc fixed to electric drill. After control of tube thickness we continue scrape with a rasp. Finish smoothing is done by piece of glass or metal sheet. Then we continue by abrading of the instrument with sandpaper granularity about 60. We use sandpaper of one granularity until graininess of the material is not the same on whole surface. Any line or groove can stay on the surface. Then we can continue with more finely granularity sandpaper. Whole process is finished by 360 granularity sandpaper when we use wet rag to clean the tube before final abrading. We damp the instrument in order to remove non adhesive fibers. The instrument is ready for varnish.

Procedure of varnish:

1. Staining
2. Oil impregnation
3. Base level of lac
4. Polish

1.4.3.1 Staining

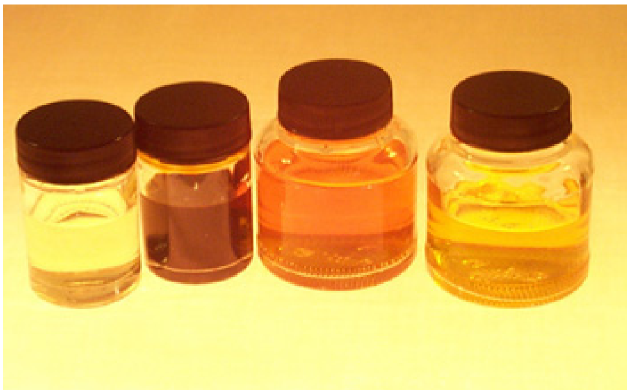
Staining is accomplished with natural stain which is made from walnut rind extracted in denatured spirit. This kind of natural stain has brown color.
Stain is applied by brush or plastic foam. Layers have to be lain on the instrument after previous one is dry. Time interval between each layer is 4 hours at least. Stain is applied only on outside part of instrument.

1.4.3.2 Oil impregnation

We use flax or paraffin oil what not only emphasize nature of the instrument but has very important role in elimination of fungus and mildew occurrence. Oil impregnation also plays a role in elimination of crevices origin due to change of climate conditions. As first we have to applied oil inside of instrument and then outside – on the surface. After that we prepare appropriate container with oil to which we dip upper side of instrument. The amount of oil has to cover whole part with tone-making device including the edge. This part stay to dip in oil for 48 hours because in this place is the instrument the most encumbered by external factors (e.g. humidity/moisture). Of course, whole instrument is coated with oil from inside and outside. After 48 hours we stop to coat oil, take out fujara from container and wipe superfluous oil. We leave to “relax” fujara for 72 hours.

1.4.3.3 Base level of lac

We use lac and denatured spirit for varnish. To prepare basic level we dilute lac and denatured spirit in proportion 1 : 2, then we leave to dissolve it and finally filtrate this solution. For coating we use “polna”. “Polna” is a rag in which is wrap a piece of fleece (of sheep) or cotton. Lac is applied attentively in 5 – 6 basic levels. Each one of level we leave to dry for a while till to level of spirit do not disappear. Basic varnish is applied in thin levels, in longitudinal direction. After this operation we leave the instrument dry for 12 hours.



1.4.3.4 Polish

Polish is prepared from the same varnish (made from lac) as for the base paint (of base level). We take a glass with diluted lac which we used for previous operation and refill with denatured spirit in proportion 1 : 1 (volume of spirit is the same as volume of previously diluted lac). “Polna” is used for application of polish in very thin levels. Then we leave it to dry until next day and meanwhile we prepare water abrasive. There are two ways:

- soap is left to dissolve in water
- drops wash liquid into water

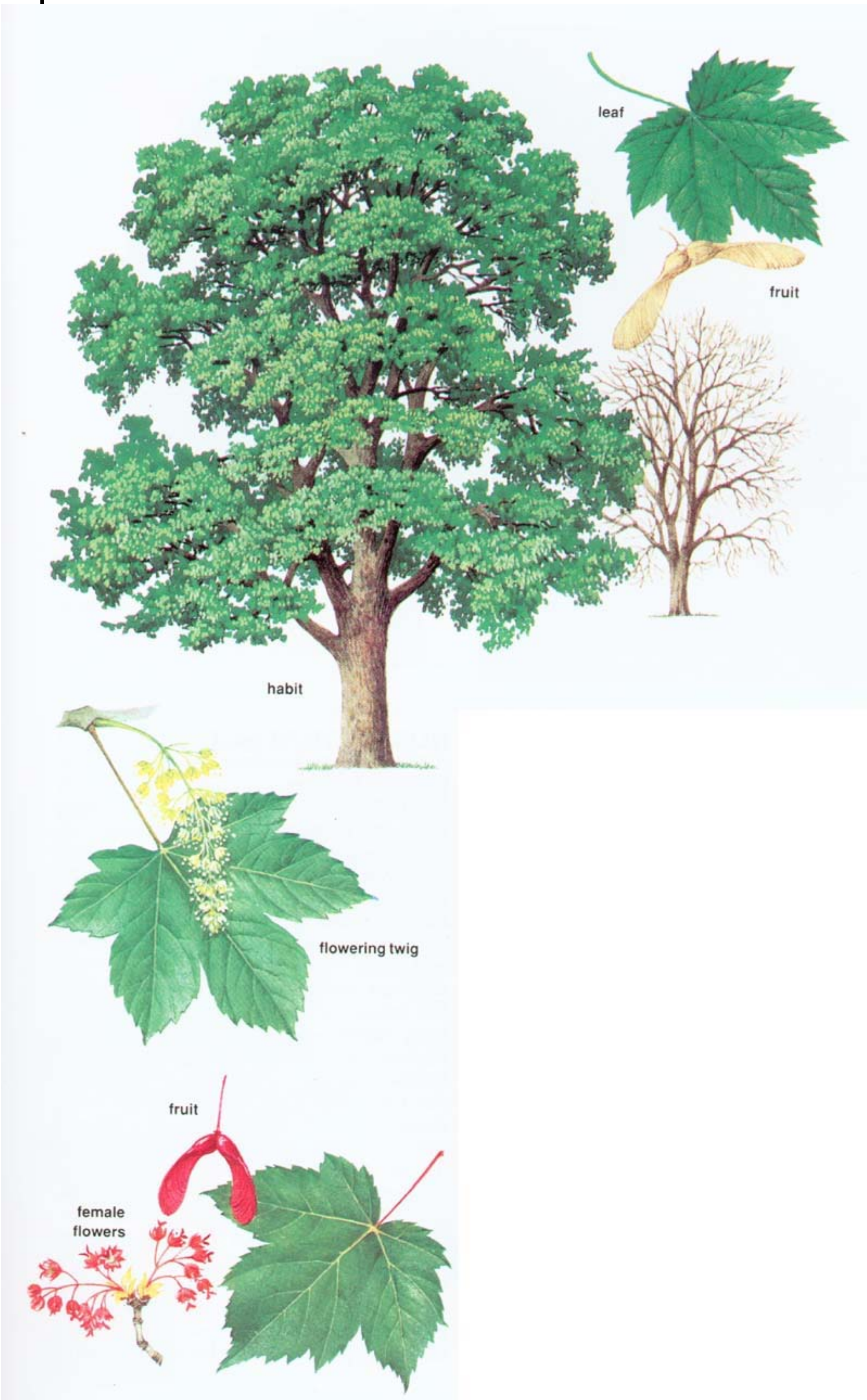
After partly hardening of polish we abrade fujara with 1500 granularity sandpaper which was dip to water abrasive. Then we continue with further levels. If we are not satisfied, we could add a drop of paraffin. Polish is applied until we are not satisfied with a shine.

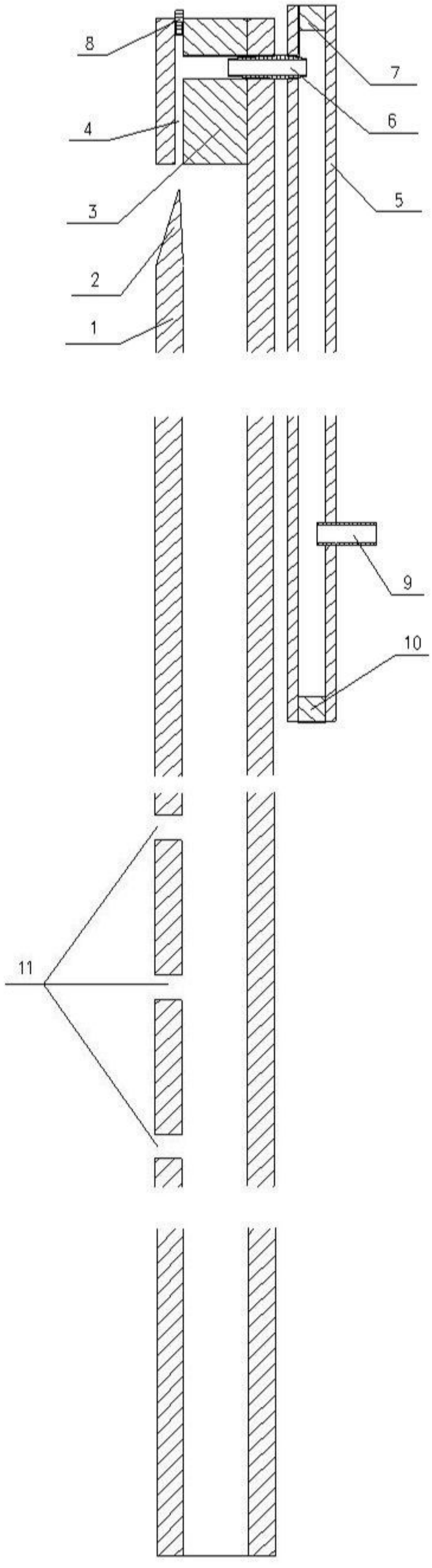
1.4.4 FINAL ADJUSTMENT OF FUJARA

Final adjustment of fujara is done after polish is total dry. We join main tube with smaller wooden pipe (air channel) through icicle and approximately in half of air channel we start to wrap leather belt. Direction of wrapping is up - to the upper end and number of “whorls” is individual. After that we put the end of leather between air channel and main (pipe) tube and pull it tight.

ANNEX

Maple - *Acer*





Construction parts of fujara

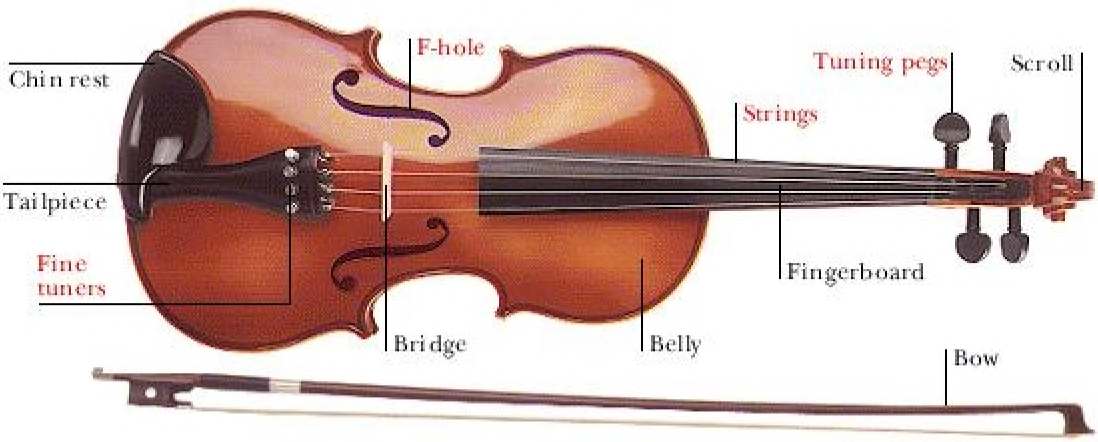
1 – Pipe (main) tube, 2 – Edge, 3 – Wedge, 4 – Air chink / slit, 5 – Air channel, 6 – Join icicle, 7 – Upper cork plug of air channel, 8 – Leather wedge, 9 - Fipple, 10 - Lower cork plug of air channel, 11 – Side tactual holes

CHAPTER 2

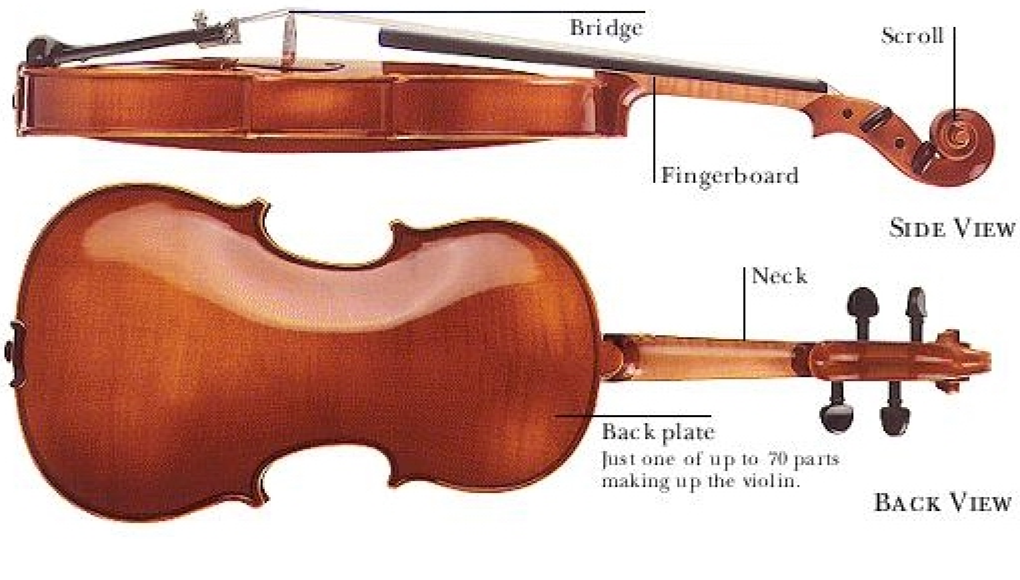
PRODUCTIVE PROCESS OF VIOLIN

2.1 INTRODUCTION

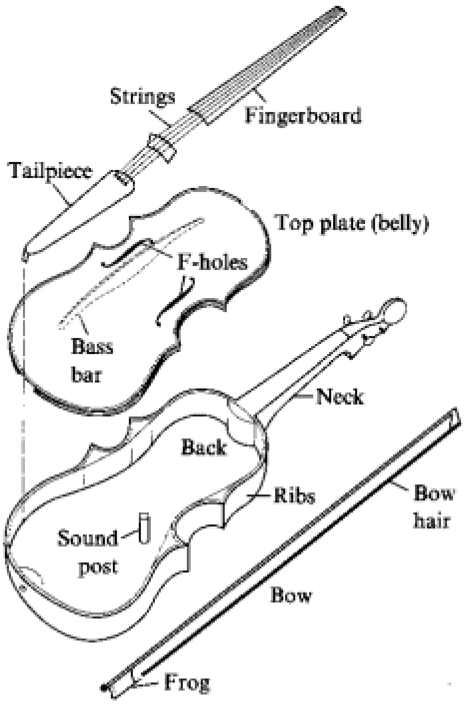
When the violin maker starts preparing to make an instrument, he must first of all consider his choice of materials and create a strategy of design. The rough flitches of wood used for the front and back plates are glued together with joints that must last perhaps for hundreds of years.



To shape the outline of the thin strips of maple called the ribs, a mould is made which is later removed from the structure. The front and back plates must be worked fairly thin to be able to resonate easily, but because they must also support a lot of tension, they are shaped into a very exact arching. The edges of the thin plates are then reinforced by the inlaying of the purfling which also serves the purpose of adding visual style. Once the outside arching of the plates has been shaped, the hollowing of the inside can begin. The graduation of the plates to the proper thickness along with the cutting of the sound holes and fitting and gluing the bassbar are really the most difficult aspects of violin making.



No two pieces of wood have the same properties and must therefore be worked differently every time. The carving of a scroll on the end of the neck of as stringed instrument has a long tradition and probably has symbolic archetypal significance. After the finished instrument has been coated in a glorious veil of tinted varnish, it can be adjusted tonally by means of the sound post and other aspects of the final fitting up.



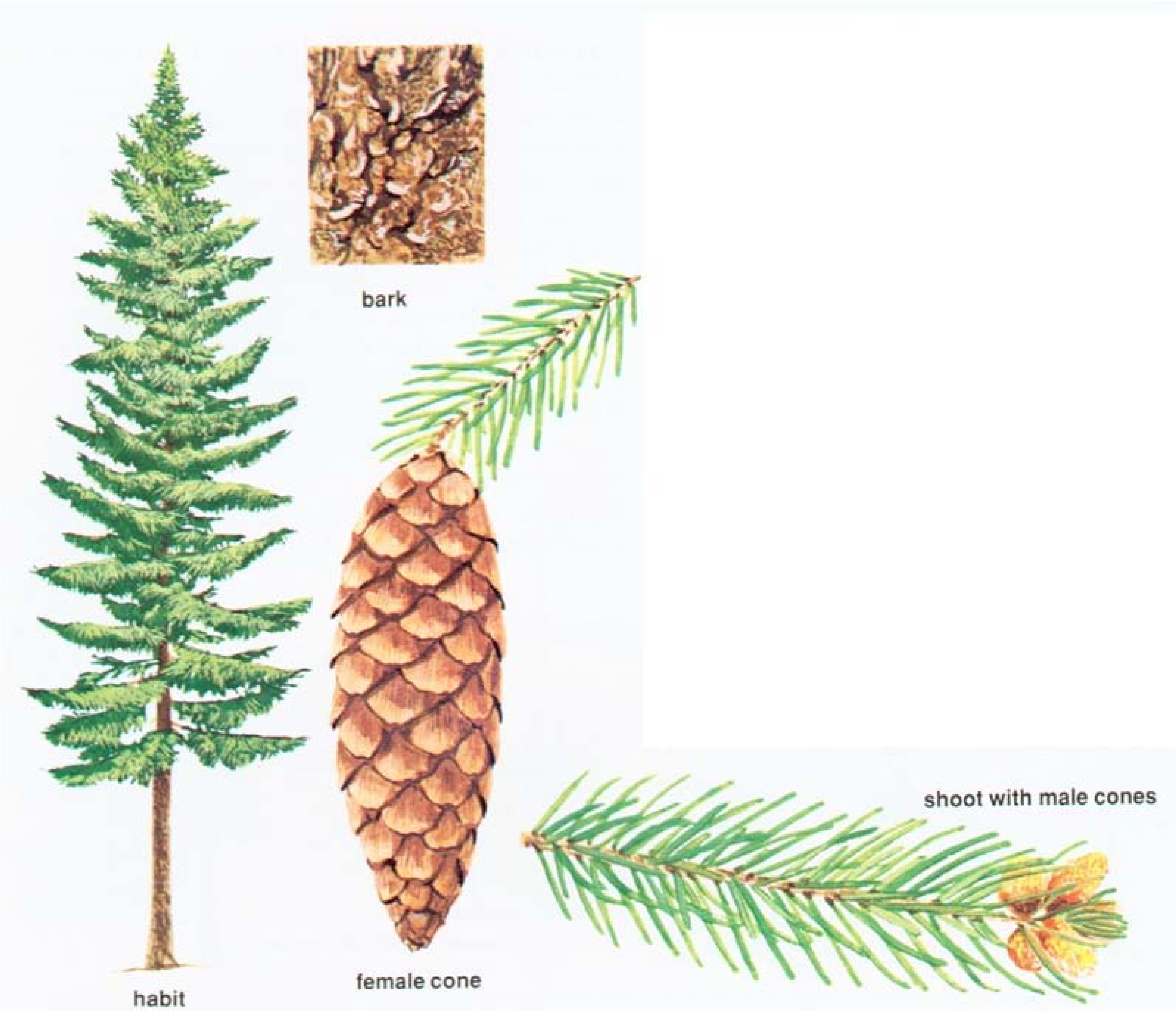
2.2 MATERIAL

The woods traditionally employed for the construction of the violin family instruments are maple or sycamore (sycamore maple) for the back, ribs and neck, and generally spruce for the belly. The variety of maple used most generally is the Acer Pseudoplatanus and Acer Platanoides. The maples are medium sized trees with long-stalked, palmately lobed leaves, small regular flowers and a characteristic winged fruit called a "samara" or key, borne in pairs. The spruce used most often for stringed instrument fronts is the Picea abies or the Picea excelsa, the common Christmas tree, with its whorled branches, narrow needlelike leaves which are borne on short peg like projections of the stem. It is sometimes said that wood suitable for violins is that which has grown at high altitudes and has had to suffer harsh conditions such as cold weather and poor soil. While this might seem slightly myth oriented, it is nonetheless true that wood which has grown too quickly in lush environments and rich soil generally tends to be less resonant and less able to withstand the stresses it is subjected to in the finished state. It is also a well known fact that air dried wood, seasoned for some years, without being kiln-dried is far better choice. This is especially true for musical instruments which are shaped to a thin form and must bear the considerable tensions of the taut strings. Normally 8-10 years are considered necessary to season quality tone wood. If fresh wood is used it will invariably distort, check and split. The violin maker bites on his wood to try to tell whether it will be strong enough. He lets it fall and listens for its ring. He will try to go by "feel".

Maple – Acer sp. **Maple - wood**

One of the benefits of felling a tree by yourself is the knowledge gained by going through the process of initially cutting and eventually seasoning the material. In fact violin making has fortunately conserved the idea through the centuries up until the present that thorough knowledge of the whole process from the rudimentary steps including the preparation of all materials is the key to a successful "feel" for the work as a whole. Even if you don’t plan to fell trees from scratch always it is certainly a valuable experience to do it at least once or twice. Very important is to de-bark the wood as soon as possible to prevent insect and fungus growth between the bark and the cambium. A treatment of the wood with borax solution is said to deter fungus which can cause staining and discoloration in the wood. An initial storing of the trunk upright in the direction that the tree grew for some weeks is beneficial (possibly to do with settlement of sap that is still trapped in the pores). Storing the wood for the first few months is generally done outside under a simple shelter as rain or moisture is not detrimental to the wood at this stage except for the fact that high moisture content attracts fungus growth and insects such as woodworm. The traditional species used are spruce for the front (Picea abies, Norway spruce-known to violin makers as Picea excelsa) and for the back, sides and neck, maple or sycamore maple- that is Acer pseudoplatanus.

Spruce - wood



Spruce – Picea abies

There are generally two ways to cut flitches from the tree trunk for violin family plates. One is radially from the core of the trunk and is usually referred to as being "on the quarter", and the other is tangentially on the perimeter and usually called "from the slab". Quarter cut and slab cut respectively

2.3 STEPS OF PRODUCTIVE PROCESS

2.3.1 JOINTS/GLUEING

The glue used for all joints of the stringed instruments is traditional hide glue made from converted collagen. Although it is very strong glue, able to hold wooden parts together with great force, the joints must be perfect. Hide glue is not an adhesive that fills gaps, so the plane iron has to be honed to a razor sharp edge and the joints planed with great precision. The main benefit of hide glue in the construction of musical instruments is its reversibility. Quite often instruments have to be repaired and restored, and hide glue will always come apart without the danger of damage if the repair is properly done. The use of synthetic glues such as PVC and the like to repair instruments has done more damage than anything else. The joints on a violin include simple butt joints such as the center joints of the plates and the complex joints of the neck. It must be considered of prime importance to the health and longevity of the instruments to have the joints in order.

In the early days of violin making, glue making was a well founded tradition in many of the arts, although it was made by each individual craftsman rather than by specialized manufacturers. Glue, like gelatin is a product of the action of heat and water on collagen and can be extracted from skin or bones. Hide glue is superior to bone glue and is generally used for making violins.

2.3.2 CONSTRUCTION PARTS AND PROCESSES OF VIOLIN MAKING

THE MOULD

The six blocks are cut and fit into recesses in the mould and then temporarily glued to the mould. When the blocks have been shaped to the final contour of the ribs, the ribs are bent on a hot iron and made to fit the shape of the mould and eventually glued permanently to the blocks. When the two plates are finished, the ribs can be removed from the mould and glued to the back or belly.

THE RIBS

The ribs are the 4-6 strips of maple or sycamore maple which make up the structure separating the back and front of the violin. They have a secondary vibrational function, but contribute considerably to the transmission of vibrations between the back and front of the instrument. They also define the volume of air inside the whole structure, along with the interior shape of the plates. The ribs are bent with heat and humidity to conform to the shape of the mould. The ribs are occasionally also built without a mould on a flat wooden plate or on the back itself.

The ribs are glued to the six blocks which remain as a structural reinforcement on the interior of the instrument. As the surface of the ribs facing the plates is not large enough to form a good joint, 12 linings made of spruce or willow are fitted and glued to the inside of the rib facing the plate. Also the linings tend to add strength to the whole rib structure.

ARCHING

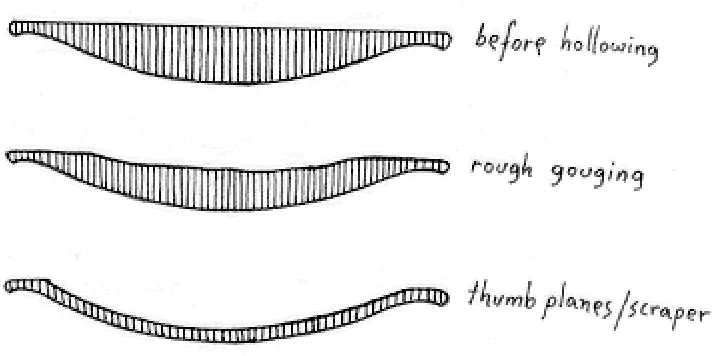
The exterior contour or arch of the back and front of a violin are carved to the shape using gouges planes and scrapers. The shape of the arching is made to give the thin plate of wood enough resistance to the lateral push of the strings and to distribute that push evenly over the plate. There are many variations possible for the shape and height of the arching. High and full, low and flat, scooped etc. each particular arch shape forcing the plate to vibrate in subtly different modes. The arch is also a feature of the aesthetic whole of the instrument which determines a maker's style.

THE PURFLING

The purfling or inlay which is traditionally incrusted into the edge of violins and various other stringed instruments has a twofold function. Most importantly perhaps, it protects the thin, fragile edges from continual wear through years of constant use and damage. Because it is inlayed to approximately half the thickness of the edge it prevents the further continuation of cracks that often begin at the vulnerable end grain of the plates and tends to hinder the process of edge wear due to contact with the fingers and hands of the player. Perhaps equally important is the aesthetic function of the purfling. The contours of the outline of the plates are enhanced by a visual trick that makes the appearance of the shape of the instrument more prominent. The total look of the outline can be expressed in an infinite variation of modes by the proportions between the relative thickness of the whites and blacks to one another and to the distance from the edge.

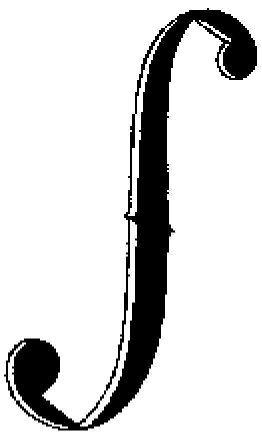
HOLLOWING

Making a violin requires great patience, especially when it comes to the graduation of the thicknesses, as each individual piece of wood has its own properties, being a natural material. It takes a long time to shape and thin the wood, tapping and flexing it until the maker is satisfied with the response of each piece. When it comes to the hollowing of the plates the maker is confronted with one of the more difficult aspects of the making of an instrument. One of the reasons for the difficulty of mass producing violins is the fact that the wood never has the same properties, even pieces of spruce or maple from the same tree. When the flitches of wood are held and struck with a blow of the fist, some pieces are found to vibrate loudly with a long ringing tone, whereas other pieces sound dull and the note dies away quickly. Of course there are also qualitative differences of the wood such as hard and heavy pieces which will require different thicknesses in the end as opposed to light soft pieces.



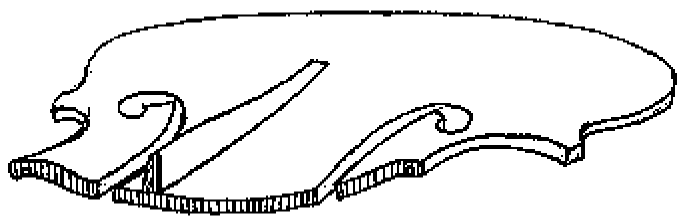
SOUND HOLES

The sound holes with their curious shape, apparently ornamental, have a great influence on the timbre of the instrument. Basically they communicate the volume of air inside the instrument (which has its own modes of vibration) with the outside air which is the medium in which the waves are carried from the instrument. The size or openness of the holes influences to a large extent the frequency of the vibrating mass of air within the instrument, and therefore the selective reinforcement of certain notes. The holes also influence the flexibility of the front plate and consequently affect its vibrational patterns. They are cut with a small fine saw and then finished with a razor sharp fine pointed knife.



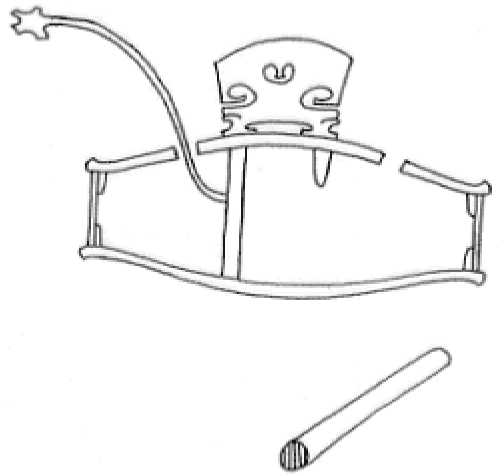
BASS BAR

The bass bar is a length of spruce cut with the grain running in the same direction as the belly, which is glued to the interior surface of the finished plate. It lies lengthwise under the right foot of the bridge about 265 mm in length. The bass bar must be fitted with great precision to the inside of the plate, but opinions vary on whether it should be glued in with spring (tension). The function of the bass bar is primarily to allow the right foot of the bridge to displace a larger area of the front when amplifying the lower notes, since the plate would flex in the immediate area of the bridge foot due to the comparative thinness of the plate. The mode of vibration of the instrument at frequencies below 600 Hz is decidedly asymmetrical, where the sound post keeps the belly relatively rigid on the left side of the instrument and allows the right side of the bridge to effectively vibrate the bass side of the plate with fairly large oscillations. A secondary function of the bar is to reinforce the belly against the push of the strings. The shape of the bass bar determines the distribution of the forces that act on it, and the height and weight of the bar influence strongly the timbre of the instrument by determining the inherent resonance of the most active vibrating part of the instrument, the belly.



SOUND POST

The sound post is a cylindrical piece of spruce approximately 6 mm in diameter in the violin, which is fitted to the interior of the instrument between the back and front. The sound post is not glued in place but is held in position by the innate tension in the instrument caused by the pull of the strings. The main functions of the sound post are to reinforce the belly on the treble side, to affect the vibrational behavior of the plates and to counteract the forces acting on the belly from the strings. The sound post is placed inside the instrument with a sound post setter and gradually shaped to fit the inside surfaces. The position of the sound post can affect the timbre of sound and the playability of the instrument considerably, as can the tightness. The Italian name for the sound post is "anima" or the "soul" because of its changeable influence on the sound of an instrument.

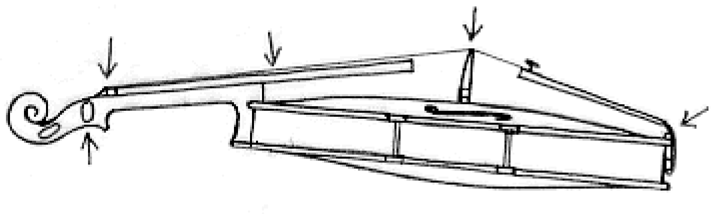


SCROLL

The scroll is the only part of the instrument which serves no real purpose, except maybe to hang it up by. It is however an important aesthetic addition to the baroque concept of the violin family instruments. It is an important part of the expression of the violin maker in terms of style and adds to the visual whole of the instrument.

2.3.3 FITTING UP

The fitting up of the instrument includes many aspects but generally involves the fitting of the sound post, fitting of the bridge, fitting and shaping of the fingerboard, nut and saddle, and the shaping and fitting of the pegs. As each sound post will have to be treated as a unique piece for every instrument and player, so does the bridge have to be fitted and cut to match the musicians personal tastes and the behavior of the body of the instrument. It is up to the skill of the maker to determine the ideal shape, cut and weight of the bridge for each instrument.



2.3.4 VARNISH

The varnishing of a violin has two aims basically. One is to permeate the wood with a substance which can protect it from dirt and sweat. Another aim is to cover the instrument with a colored sheath of varnish proper which has a purely aesthetic function. The "ground" or substrata which close the wood can have a considerable influence on the behavior of the sound by affecting the stiffness of the plate. The colored varnish sitting on top of the ground, and wears off with time, is meant to enhance the appearance of the wood, but can be detrimental to the freedom of vibration of the plates if it is applied too thickly or has too hard a consistency. The varnish should ideally be thin enough and light enough not to constrict the instrument.

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