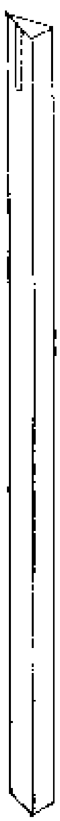
Volume 2, Chapter 13: Good Work Requires Sharp Tools

The *Analects*[1] state: "The artisan who would do his work well must first sharpen his tools."[2](2) This means that any artisan will investigate things exhaustively and only then be able to perfect his labors. But tools must be used for the work and if they are unfit, then the work will not serve. If the tools are not sharp, then the labor can not be made good. One must rely on tools. It is imperative that before the work begins, the tools be made sharp. Otherwise how can one's aims be achieved? Only then can excellent work be done.

Modern watches from England, and other things, are made with such surpassing craftsmanship that nothing could be added, and what is the reason? Sharp tools of quality (are used). If this sharpening of the tools is ignored, then it will not matter how good a carpenter one employs, he still will not be able to exercise his abilities. The rules of construction cannot be set aside. Building an excellent ch'in is not limited only to compass, square, level and plumb line. There are other tools and their individual illustrations and instructions can be found below:



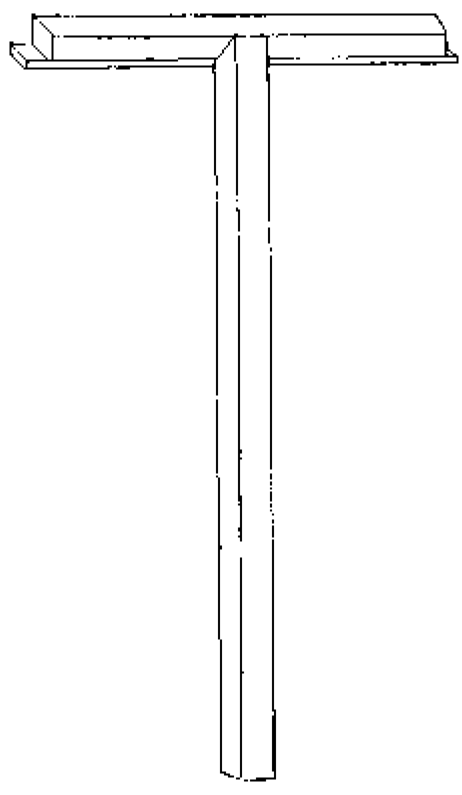
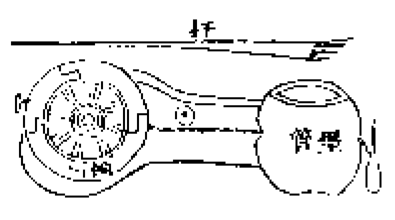


Figure 1: Ruler, T-square and ink cup with stirring brush and carpenter's line



[1].The *Analects* is a book consisting of the sayings of the philosopher Confucius, who lived around the fifth century B.C.

[2] *Analects*, 10/9.

The long ruler:[3] Choose sturdy, straight wood. *[For example, the yew and ginkgo will not warp. Their wood is fine, delicate, bright and smooth, extremely beautiful.]* It should be old, thoroughly dry, hence unvarying in shape. All long wood pieces are subject to warping. It should be extremely straight. The ruler should be four feet in length and one inch or so in width. One side should be one inch in thickness and the other side should be sharp like a knife edge. Mark each of its forty inches and mark those into tenths. On the flat side at the head end, about 25/100's of an inch away from the bottom, mount a pin and take a piece of copper, nailing it in so that the pin is immobilized. The head of the pin should stick out about a half inch. Lay out a carpenter's line on the surface of a long board first in order to check the straightness. Also check and correct the thick side and thin edge (when completed). This is the first tool and its uses are many.

The method for the T-square:[4] Use sturdy wood. *[Tzu-tan or boxwood or the like, or copper is all right.]* There are two sections, one horizontal and one straight. The straight section should be a foot or so long, *[The longer, the better]* half an inch wide, and 3/10's of an inch thick. The width and thickness for the horizontal piece are analogous, and it should be six inches in length. Both pieces should be extremely straight. On the wide side of the horizontal piece, open up a flat hole and join the two pieces. The hole should go through both sides. The hole should be .12 inches wide and .5 inches long. On both sides of the hole leave .09 inches. This is the method of the mortise. On the wide sides of the head of the straight piece remove .09 inches, leaving .12 inches. This (section) should be .5 inches long. This is the method for the tenon. In carrying out this process, there must be male and female. The male enters the female part, and thus a T-square is made. The straight and horizontal pieces must be extremely straight. There is a square corner where the two pieces come together and it is necessary here to use the squaring method. Take a piece of paper and draw on it a straight line. Then at right angles, make another straight line, forming a cross. Put the T part of the T-square on (the cross) and carry out the squaring method. Take the horizontal part and lay it precisely flush with a square line. Compare. There must be no discrepancies. Compare on the perpendicular as well, so everything will be correct. In order to immobilize them, it is best to nail the joints together. Then compare to make sure there has been no movement. Or utilize a thin, extremely straight piece of copper, .5 inches thick, width like the horizontal piece, and 6.2 inches long. Reckoning widthwise, it should match up with the horizontal piece. Lengthwise, it should be .1 inch longer on both sides than the horizontal piece. These sides should be flush to the ends of the horizontal piece. Nail the metal in the middle. *[Use two nails so it will not move.]* Then, using the square, the two ends of the copper piece should be down, so when it is placed on the face of the ch'in, the ends can be pressed down. This will be of help in drawing the hui positions.

Ink cup:[5] Use a bamboo tube with a diameter of 1.5 inches and with height the same. Take one end as the bottom; the ink can be concentrated there with a cloth. *[This refers to dipping a cotton cloth into well-ground thick ink.]* In the waist of the tube, on the left

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[3] Figure 1.
[4] Figure 1.
[5] Figure 1. The ink cup is used in conjunction with the carpenter's line.

and right, open up a small eyehole. These two should be opposing, and capable of taking a fine string. Take another piece of sturdy wood, five inches long, .5 inches thick, and two inches wide. On one end fix a ink tube and on the other affix a small wheel. On the side place a small handle, so that it can be turned, wheeling in the ink line. Make a fine line, five to six feet in length, and tie one end on the wheel, the other end being put through the eyes in the ink cylinder. It goes in on the left and comes out on the right. Tie the other end onto a handle with a sharp end. Also make a bowl cleaner. Use eight inches of bamboo, retaining the outer layer. One end should be pared round like a rat's tail. The other end should be made flat, about .3-4 inches wide, with thickness of .1 inch. It should be pared off like the edge of a knife. Following its nature cut (this end) into extremely thin pieces, almost down-like. This tool facilitates moistening the ink. In making straight black lines, use a bamboo tally to poke the ink cloth, causing it to coat the line with ink clear through. Take the line and extend it, keeping it straight and press it down on the object in question, thus you will produce a long, straight black line. If not enough ink is gotten on the line, then repeat this procedure, and make sure by moving the line back and forth, until it is coated. Use this tool for straight lines. TBD. Missing picture.

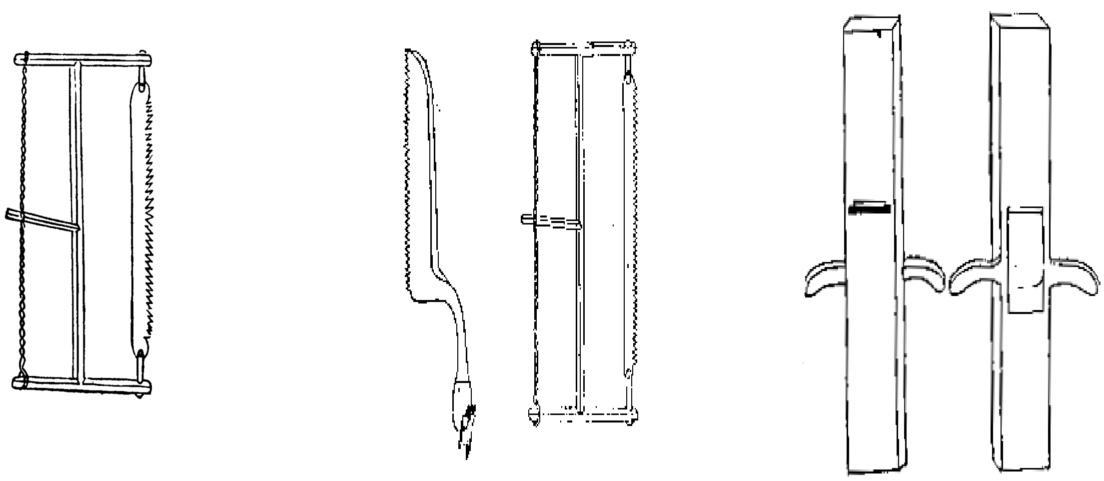

Figure 2: saws (straight, hand, transverse) and front and back view of long plane

The straight saw (ripsaw) is two or more feet in length, three to four inches wide. The teeth are sharp and slanted. They point up or down. It is best to use a thin piece of iron. Use wood above and below, as well as transversely for support, and also place a wooden brace in the center. Now on the right ends of the transversal braces, open up holes of a diameter of .2-3 inches. Make (two) other round wooden pieces, about .25 inches in length and stick these in the holes. Open up a seam in the short pieces, about an inch, grasping the saw blade. Fasten it so that it is movable. (The blade) is fastened straight on the right, and on the left a cord is fastened. Use a thick bamboo piece and twist the cord up tight, this keeps the blade tight. This saw is used for cutting straight (with the grain) across wood.

The transverse saw (crosscut saw) has sharp and straight teeth. The cutting edge slants to the left and right.[6] Use pincers to twist (the teeth) like so in every space. The rest is like the straight saw. This saw is used for cutting wood crosswise (across the grain).

The handsaw's teeth are sharp, even and straight. The blade is fine and small. It should be a foot long, and half an inch wide, with a curved handle. It is used for cutting the grooves for the bridge and ch'eng-lu.

The long plane should be made of sturdy wood. It is essential that it be level and straight. It should be twelve to thirteen inches in length, two or so inches wide, and an inch thick. There should be handles connected to it on both sides. A square hole should be cut in the head. Put an iron strip transversely there. In the base open a wide and narrow slit, and put a sliver of steel there, making sure that it is even in the slit. A thin edge should project. Secure this with a piece of wood. The long plane should be used for planing objects flat.

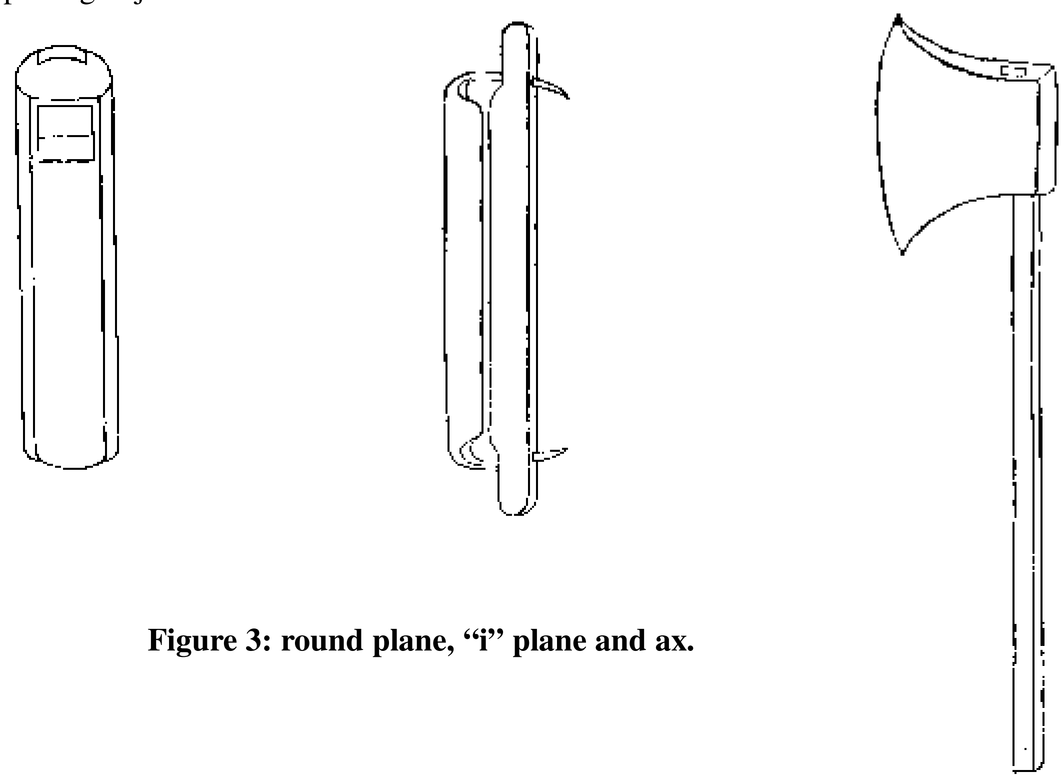

Figure 3: round plane, "i" plane and ax.

The round plane also should be made of sturdy wood. The length should be four inches, with width one inch, and thickness one inch. The shape of the bottom is half rounded and the thin blade is similar. As for the rest, it is the same as the construction method for the

[6] Cross cut saws have a wider set than rip saws. Alternate teeth project to the side from opposite sides so that the saw-cut is wider than the blade.

long plane. It is not important whether or not there is a handle. This plane is used for finishing the face and interior of the ch'in.

The **"i"-character plane**[7] should also be made with sturdy wood. The length is eight inches, with width and thickness both half an inch. The ends serve as handles. Make a piece of steel with a shape, with its length five inches, and width .6 inches. Mount it on a length of wood. Make sure it is secure, with the points slightly protruding. It is used for finishing the bridge and face.

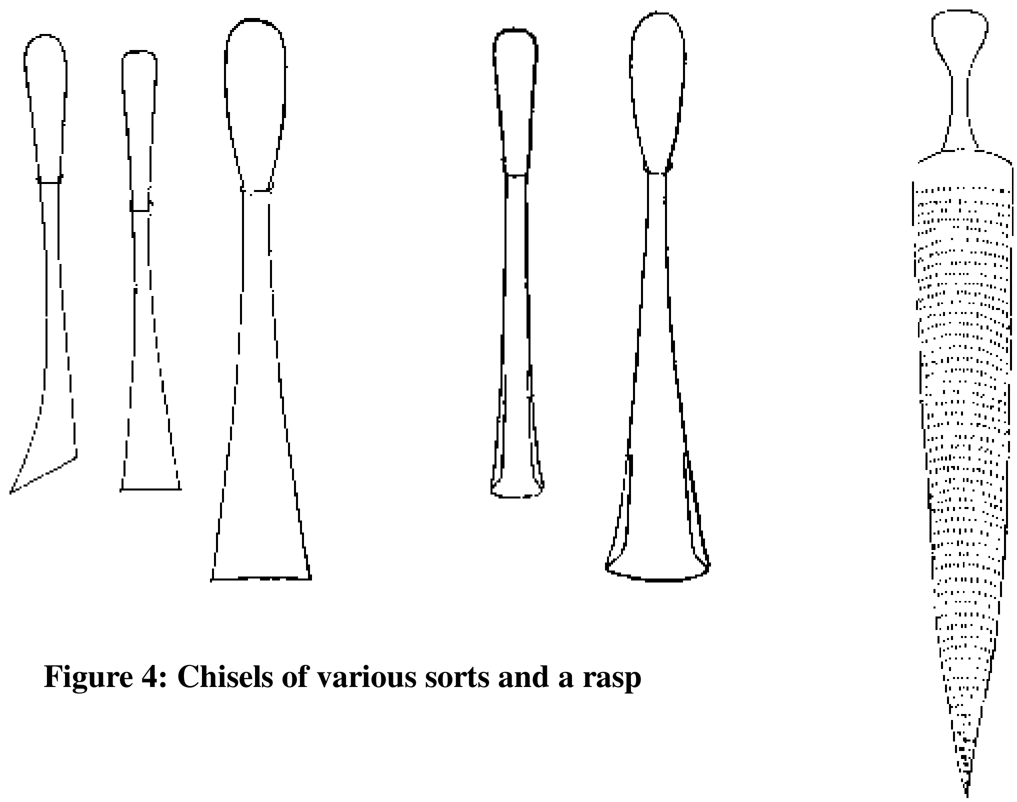

Figure 4: Chisels of various sorts and a rasp

Use a **small axe**, do not use a big one. It is used occasionally for splitting wood and that is all. Use iron to make it. (However) the blade itself requires steel. In a pinch it can be used for a hammer for striking nails. The handle should be made of hardwood.

Big round chisel (gouge): The edge should be thin. It should be made of steel, with width, one inch. The edge has a slight half-rounded form and could be used as a spade. Use it to chisel out the inside of the ch'in, and to cut open the places for the nut and yin-t'o, et cetera.

Small round chisel (gouge): It has a small edge. It should be of steel with width .35 inches. It should be round like a fingernail, and can be used for cutting the holes for the hui.

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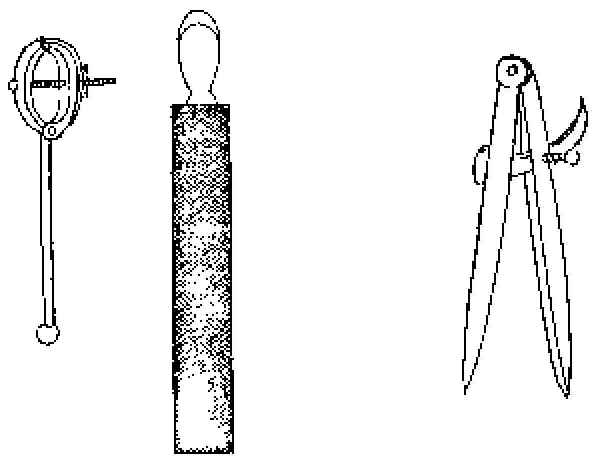
[7] That is, a plane that is shaped like the Chinese character "i" (一), number one. This suggests that the blade of the plane is almost flat like the character itself, so that this is actually a scraper

Square chisel: The edge is thin and should be of steel, with width .7-.8 inches. It can be used in finishing the chiseling out of the inside, along the edges, and also along the edges of the pond and pool.

Small square chisel: The construction is identical (as above). The width is only .4 inches. These are utilized in opening the holes for the wild geese feet.

Curved sharp (edge) chisel: The construction is like before. The width is .4-.5 inches. It is used in finishing up the cavity for the nut, and in refining borders (inside the ch'in).



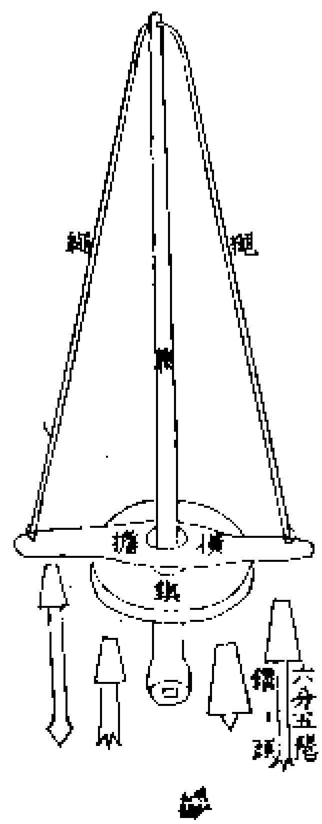


Figure 5: Clamp, square file, compass, and drill with various bits

Tiger-tongue rasp: The length is one foot or more. The head is one inch wide and the tail gradually tapers to a point. One side is flat and one is convex. The thickness is approximately .2 inches. The two edges should be like the edge of a knife, but blunt. The points of the teeth over the entire surface are raised high. It can be used in removing the lacquer-powder mixture and in fixing the various round and square places like those of the shoulders and neck. It has many uses.

The square file: Its length is five to six inches, with a width of .2 inches, and a thickness of .4 inches. It is used in preparing the hui.

Small hand clamp: Its length is five inches and it resembles a set of pincers. A screw is used for tightening so that objects can be securely grasped. Thus one need not use one's hands. It is used in the making of the hui and also can be of convenience in the use of the chisel.

Drill: In the center set up a trunk, and use a piece of iron, with a diameter of .2 inches. The length should be one foot and four inches. However the bottom end should have a diameter of .3 inches or so. In the center of the bottom, cut open a square hole of .2 inches. The bits are put here. On the top half of the trunk open a small hole, through which a cord will be passed. Also make a round iron guard with a diameter of two inches, thickness of .3 inches. In its center make a hole. Put the trunk through this and arrange it so there is no movement. Also take a thick piece of bamboo to make a transverse brace. Its length should be nine inches, with width in the center, .6 inches. Open a hole in it slightly bigger than the trunk and put it on the trunk over the guard. In the two ends of the brace, open a couple of small holes. Take a hemp cord, two feet and two inches in length, and thread it through the hole at the top of the trunk. Divide the cord into two equal parts and tie the ends through the holes of the braces. Also make some metal bits and put these in the square hole in the base of the trunk. After this stand the drill up and cause the cord to twist around the trunk. The bamboo brace will follow the cord and rise up. Use it like this: Take the middle and ring fingers of the right hand and lightly pinch the body of the trunk. At the same time press the brace down and let the cord turn. The brace will go down and the bit will enter the wood. But the two fingers must be in place, taking advantage in a natural way. The drill will begin to descend and twirl around. It must not stop or be blocked. When one's skill is perfected, it can be used to drill the string holes. Many kinds of bits are useful. But it is essential in consideration of the method used in rounding the face, that the drill be the prescribed length. It can not have the slightest divergence. One should check for accuracy.

Small compass: The height is three to four inches. It is necessary for making circles. Add a screw so that it can be set and thus no changes will occur. The compass sets standards. It is useful in making the hui.

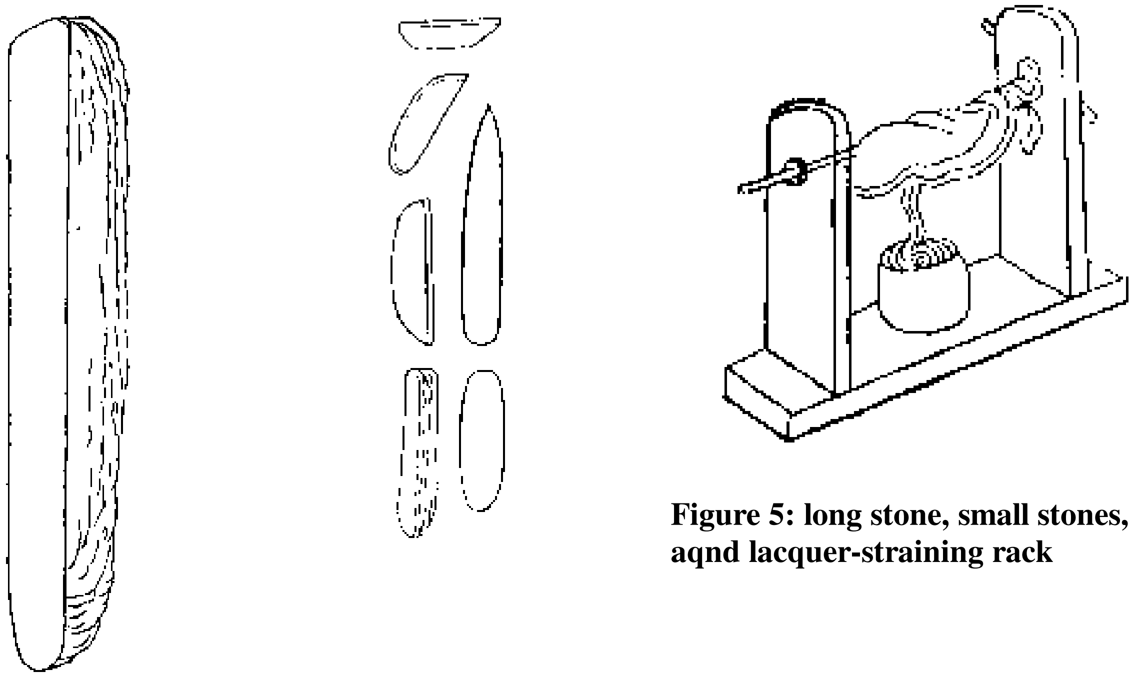


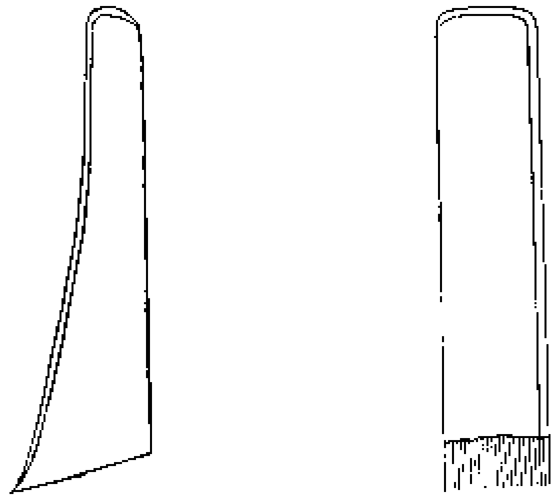
Figure 5: long stone, small stones, aqnd lacquer-straining rack

Rubbing stone: It is a foot or more in length. *[The longer, the better.]* The width is two inches, with three inches for its thickness. One side should be extremely flat and straight. As for selecting a good stone, it should be solid and slightly rough, but not smooth. Thus it will be easy to smooth the lacquer-powder mixture. But it should not have any ridges or rough spots. If it is smooth, then it will be difficult to rub anything smooth. If too coarse, then scarring may occur. It must be the given length, then one can rub straightly. It should be heavy, so that when pushed it will have a natural feel. It is only used in smoothing the lacquer-powder mixture and in ridding the surface of striking noises.

Various (smaller) stone pieces: There are no rules for the various sizes. Stones varying in length, width, sharpness, and roundness should all be at hand for use in rubbing sharp corners. Also these can be used to perfect the bridge, nut, ch'eng-lu, feet, and phoenix tongue (areas).

Lacquer straining rack: Use sturdy wood to make one. The base piece is two inches thick, eight inches wide and one foot, six inches in length. At its ends, set in two inches respectively, set up two wide boards. They should be one inch thick, six inches wide and one foot tall. On their heads, inset one inch, open a round hole with a diameter of .5-.6 inches. Take some good hemp and make two ropes, each one foot long and as thick around as a middle finger. The rope ends should meet and be united, making a ring. Fasten them securely so they will not come loose. Take the rope rings and put half into the holes in the upright boards. Now take two hardwood sticks, each one foot long, as thick as a thumb, and put them through the rope rings on the outside of the upright boards. Take the ends of a package consisting of linen with lacquer wrapped inside and

Figure 6: bone comb and lacquer brush



wind this into the rope rings on the inside of the upright boards. *[As for the ends of the package, bend and twist them when they are being put inside the rope, and then wrap them on the inside of the rope rings, thus they will be stuck and will not come loose.]* Turn the sticks in circles and gradually they will tighten. The lacquer will come out. One person should manage each side. First take linen, two feet by one foot, and pour clear water on it. Stretch it out in a big bowl and fill the bowl with lacquer. Afterwards wrap the package up. Do not permit any lacquer leakage. The two ends of the package are put into the rope rings and then two people start twisting the sticks, gradually tightening the package. The lacquer will be strained out. Use coarser cloth the first time in order to remove sediment; and the second time use finer cloth and add some thin cotton cloth or silk. Twist again and the lacquer will be clear and clean. The lacquer used for the (step of) "bringing out the shine" must be strained several times, thus it will be pure without any dregs. After straining, if the linen has not torn, take tea oil[8] and wash out the lacquer. A lye solution should then be used to wash out the oil. (Finally) use clear water to soak out the lye and the cloth can be retained for future use. Otherwise the lacquer in the cloth will harden and become rigid. If it is soaked with lye and oil, it will not dry.

Bone comb: Make one from cattle horn. The length is three to five inches, with width, two to three inches. The top is narrow and .2 inches thick. The bottom is wide and thin like a knife. The lacquer craftsmen use this tool to spread the lacquer-powder mixture, but in this fashion it cannot be evenly distributed.[9]

Lacquer brush: Take the back hairs from a pig and wash them clean. Let them dry in the sun. Make them equal in size and use hide glue to stick them together]for about four

[8] Oil from the seeds of Thea Sasanqua, the tea plum, a member of the tea family. Cf. *Chungwen Ta Tz'u-tien* , p. 12241.
[9] In the previous section (Volume 2, Chapter 6: *Rubbing the Powder On Smooth*) the author suggests using a brush.

to five inches. In addition obtain two thin bamboo pieces, four to five inches long, one to two inches wide, and .05 inches or so thick. Now take the bristles and using glue, put them evenly inside (the bamboo pieces) so that they are approximately .1 inch thick. Take the bamboo strips and pinch the bristles together. Wrap some silk around the outside. Use lacquer mixed with flour to cement tight (the silk). Or use a line to tie it up tight, and add lacquer on the outside. Wait for the lacquer to dry and then use a knife on the end, lopping off a few tenths of bamboo. Do not cut into the bristles. This exposes the bristles, and one has a brush! Hot water will flush away the glue in the bristles and the brush will be soft and ready for use. After using it, take tea oil and wash out the lacquer, a lye solution to wash out the tea oil, and clear water to wash out the lye, otherwise the lacquer will dry and harden, making the brush unusable. If this happens, one must lop off a few more tenths of an inch, exposing more of the bristles. If one makes a round brush, it will be impossible to pinch together the bamboo pieces. Make the bristles into a cylinder, big or small, and then tie a string all around. Lacquer it, and after it is dry, pare it to make a brush.[10]

[10] This brush describes well the variety I purchased in Taiwan in 1976. Turpentine and lacquer solvent can also be used to clean the brushes.