Volume 3, Chapter 9: The Method for Making Strings

Note: In addition to the original text, please see a modern commentary at the end of this chapter.

The very best kind of silk for strings is made from the che (柘) tree.[1] The next best is made from silkworms fed on mulberry leaves. The third best is made from original silkworms, [second silkworms].[2] The che kind is clear and the mulberry variety is soft. The strings get finer as one proceeds from number one to number seven. There are also a set number of cords used to make up each string. Also strings one to four have an added wrapping.

The method of manufacture: There are three kinds, T'ai-ku (太古), Chung-ch'ing (中清), and Chia-chung （加重). Chung-ch'ing is the most suitable. In all cases use "material glue"(料膠)[3] and boil the strings with it after the strings are made.

The method for matching up the cords: Silkworms make their cocoons out of one thread. Every cord is made of twelve threads. If there are too many threads, then the cord will be too thick. If there are not enough, then it will be too thin. The first string should be made up of one hundred and eight cords. For the second string use ninety-six cords. For the third string use eighty-one cords. For the fourth string use seventy-two cords. For the fifth string use sixty-four cords. For the sixth string use fifty-four cords. For the seventh string use forty-eight cords. These are Chung-ch'ing. For T'ai-ku add twenty percent to every string. For Chia-chung add fifty percent on every string. Every set of Chung-ch'ing weighs about three and a half ounces. T'ai-ku weigh about four and one fifth ounces. Chia-chung weighs about five and one fifth ounces.

The method for winding up the strings: First take eighty feet of string cords that have been matched up and divide this up into three or four bunches. For every bunch use a suspended foot of weight four ounces.[4] Revolve it to the left and twist the cords extremely tight. Let it turn to the right and come together becoming a string approximately sixty feet in length. Cut this up to make ten strings.

The method for boiling strings: Take the strings, which have already been wound together and wrap them on a bamboo rod six inches in length. Use a new earthenware cooking pot with a flat bottom *[a new iron basin is also satisfactory]*. It should be eight inches in height with a diameter of four inches. It should have the capacity for eight rods with strings wrapped around. Use material glue and water and immerse the rods with strings to two tenths of an inch. If too deep, then the strings will be soft. If too shallow,

[1] Cudrania triloba. Cf. Porter E Smith *Chinese Materia Medica* (see bibliography), p. 137. He mentions that these leaves are especially valued for "lute" (ch'in) strings.
[2] This is the summer or second crop of silkworms.
[3] Defined later in this chapter.
[4] This is the weight that is put on the end of the strings.

then they will be hard. Use a flame that is neither too mild nor too hot and boil them. Wait until the wheat has been cooked until done and then stop. If it is not cooked long enough, then the strings will not be able to make the wood resound very well and after a short while there will be no sound. If cooked too long, then the sound of the strings will not be clear and the strings will be easily broken. When boiling, check to make sure that standards are being met. At their best the strings should be opaque and lustrous. Now take the strings and put them in cold water so as to bleach out some of the glue on the outside. Now quickly take the strings out and hang the ends up so that they can dry in the sun.

To make material glue: Use five ounces of clear fish glue.[5] *[First boil it and then strain it clean.]* Also use a spoonful of wheat, *[choose and wash clean]*, five ounces of glistening white wax,[6] five ounces of pai-chi (白芨)[7] *[sliced]*, one ounce of mulberry pai-p'i (桑白皮) [8] *[peeled, washed, and grated]*, and ten t'ien-men-tung (天門冬)[9] *[sliced]*. Use pure water and put everything in the bowl. Heat it until it is done. This glue

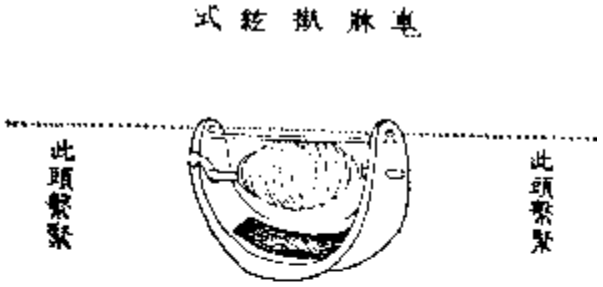
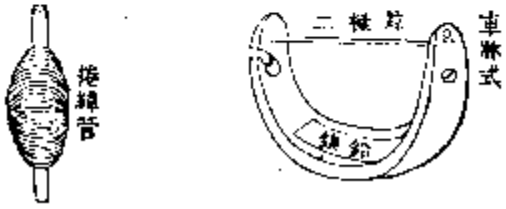


Figure 1: winding machine



[5] Made from the swimming bladder of a fish. This is also known as isinglass.
[6] "White wax" or "cire blanche" or "Chinese wax" is an insect secretion from *Coccus sinensis*. Cf. ibid, pp. 237-8. The bug or bugs in question are also called Ericerus pela. Another possible name is Ceroplastes ceriferus. In English the bug may be called the Chinese wax scale insect. Its wax may be used for candles. Note that the Indian lac scale insect produces shellac. See Wikipedia under "Chinese wax" for more information.
[7] *Bletilla hyacinthina*, a kind of orchid with violet flowers used in Chinese medicine. It is related to the hyacinth. The bulb is used to make glue. See Wikipedia under Bletilla for more information. The powder form is known as Bletilla powder.
[8] White bark from the roots of the mulberry.

can be usedfor boiling ten sets of strings. As for whatever strings one may have, after being immersed in this glue and sunned dry, their sound will be like new. Or take mulberry leaves and pound them into juice. Soak the old strings in the juice. Their color will be an emerald green.

The method for wrapping the strings: First take six cords to be the woof or wrapping. *[Woof means crosswise; warp means straight.]* These should be very long. The strings should already have been boiled. Wrap them on a small bamboo rod. Now make a winding machine[10] out of date wood. It should be strong and heavy. Take the rod with the woof wrapped on it and mount it on the winding machine, so that it is movable and can turn. Now take a string that is twelve feet in length with both ends fastened tight and hung up straight horizontally, *[or suspend it from pillars left and right]* and put it through the warp string bunches. Afterwards shake the string and cause the winding machine to turn over itself. Therefore the woof on the rod will follow the revolutions and go out. Wrap it on the string body little by little. Although the rod for the woof is mounted so that it is movable, nevertheless the tips of the rod should be made somewhat tight so that the woof does not move too easily. In this way, the wrapping will be made Also two round iron rods are used on the cart in order to pinch the woof in the crack between them, thus making sure that the woof is flattened and not round. Everything depends on this. If done properly, then it should be uniform, without scars. If the woof breaks, take the string, and using a needle, put it back through the warp, taking care that there are not any traces, then continue wrapping. Leave a foot or more between the heads of strings. Start and finish wrapping and then cut in the middle to make two. This is very convenient. Strings three, four, six, and seven are played a lot. Moreover they are finer and they are thus more easily broken. So their overall length should be a foot or longer than strings one, two, and five, in order to ensure that when they break, there will still be string remaining. Beginning ch'in students use their fingernails too vigorously and damage the strings. So if one is careful when practicing, and avoids striking noises, then the strings will last for a long time.

As for the winding machine, carve it as a whole out of one piece of wood. It should be concave in shape, with the two heads high and the center low. In the middle of each of the two raised ends, drill out an eye for fitting the string warp. Under the eyes put the rounded, crosswise iron rods, which should be parallel. These have a narrow crack in the middle for the purpose of pinching the woof flat. Underneath, in between the necks of the iron rods, open small holes just as big as the rod for the woof. These holes are female and the tips of the rods are male. Thus one can be sure that the rods will be suitably mounted and free to revolve. It also makes possible their tightness. If the winding machine is too light, then mount some metal on the bottom of it. It is essential that the revolving of the winding machine should have some force in it.

Modern commentary: The comments here are based on a conversation with Huang Shuzhi (黃樹志) in Vancouver British Columbia in June 2009.
Mr. Huang states that based on his experience, overall the chapter is more or less accurate with one important exception: the cord counts are wrong. There are two

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[9] *Asparagus lucidus*, a creeper; the tuber is used in Chinese medicine. Cf. ibid, pp. 55-6.
[10] See Figure 1.

reasons. First Mr. Huang states that the numbers used (string 1 at 108, etc.) are based on the cycle of fifths, which may represent a nice theory, but does not represent the reality of traditional string construction. Also all the cord sizes for wrapped strings need to reflect the fact that fewer cords overall are used for the lower wrapped strings. In other words the numbers for wrapped string 4 should not be more than unwrapped string 5. Using the cord counts in the text, post wrapping, would make strings 1-4 too big. In reality although the numbers for a set of string cord counts will of course reflect the overall density (gauge), relative cord counts are basically linear with a considerable decrement to make up for wrapping the lower heavier strings. One should also note that older instructions for silk string making in the qinpu literature assume that only strings 1-3 were wrapped. The fourth string was not wrapped until later. Mr. Huang points out that the Ming dynasty qinpu, Qinshu Daquan (琴書大全) from 1590, has correct cord counts as follows:

string 1 – 120
string 2 – 100
string 3 – 80
string 4 – 120
string 5 – 100
string 6 – 80
string 7 – 60

Note that string 1 internally (before wrapping) has the same cord count as 4, etc. Also note that the counts are basically incremented by a fixed number (in other words if you graph them per string you will see that the relative change in size is fixed, and the graph itself will be linear with a step down at the lower wrapped strings). These counts assume strings 1-3 are wrapped and strings 4-7 are not wrapped. Again modern strings as in the Yuguzhai would have strings 1-4 wrapped.

The cooking and glue process is also of interest. First of all one should understand that in the cooking process, fundamentally the most important aspect is that the sericin protein, which is a natural part of the silk threads, comes out of individual threads during cooking and is distributed amongst the cords in a string. Thus sans any other glue, this helps glue the string together. Put another way, raw silk comes with its own natural glue. See the Alexander Raykov article at John Thompson's web site for more information: [http://www.silkqin.com/03qobj/strings/raykovstrings.htm, July 6 2009].

Mr. Huang told me that the glue itself is not necessarily an exact recipe. Like any cooking recipe the ingredients might vary. The wheat is for timing - the cooking is done when the wheat is cooked. One might use some other kind of wax as opposed to white wax. Bletilla is also traditional glue. So is fish glue (isinglass). Both are available. Other ingredients like asparagus lucidus are not hard to find for that matter. Asparagus lucidus was added to the glue recipe because it has anti-bacterial properties (and possibly anti-fungal properties). Silk after all is a natural product and may be damaged by rot or other problems.