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Cottage Industry Manuals

Bamboo Mat Weaving Techniques and Applications

EASTERN AFRICA BAMBOO PROJECT

funded by



executed by



supervised by



ETHIOPIA
Ministry of Agriculture and Rural Development
Federal Micro and Small Enterprise
Development Agency

KENYA
Kenya Forestry Research Institute

COTTAGE INDUSTRY MANUALS

BAMBOO MAT WEAVING TECHNIQUES AND APPLICATIONS

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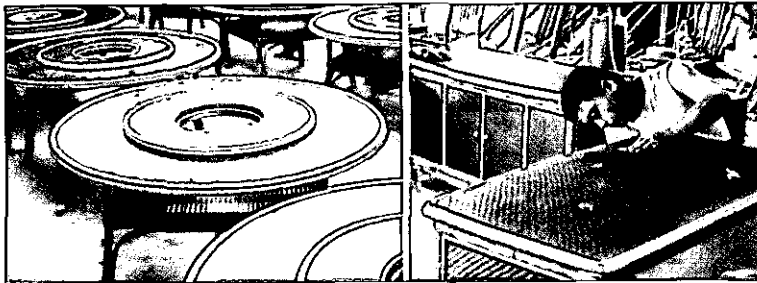
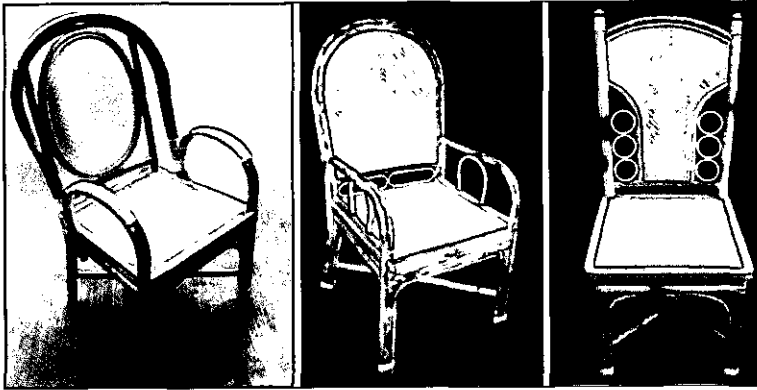
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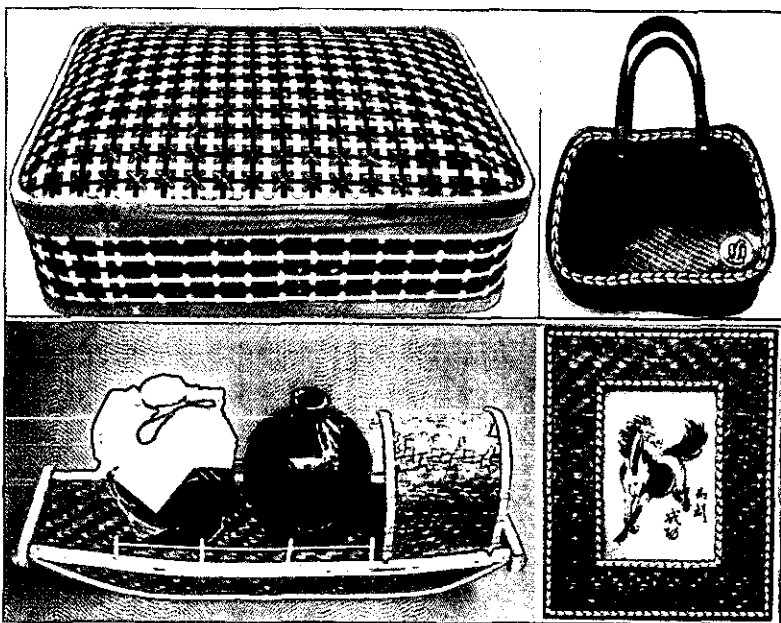
I. BAMBOO MAT APPLICATIONS

Bamboo mats are plane woven bamboo products that are designed and finished for numerous applications, especially interior design and furniture.

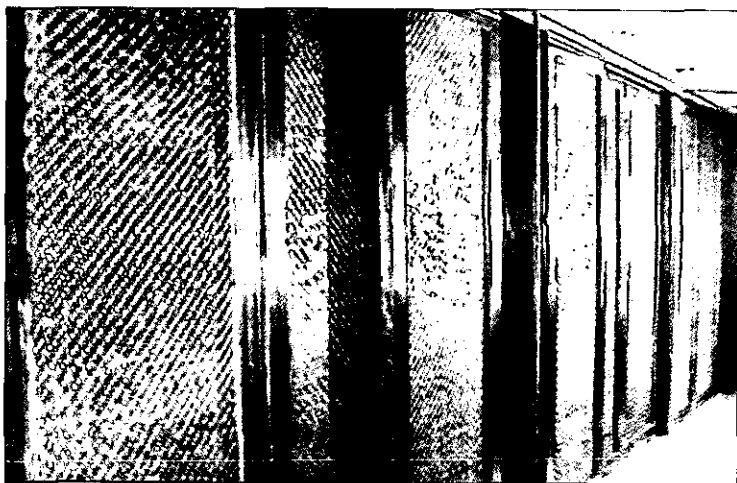
Some examples are shown below.



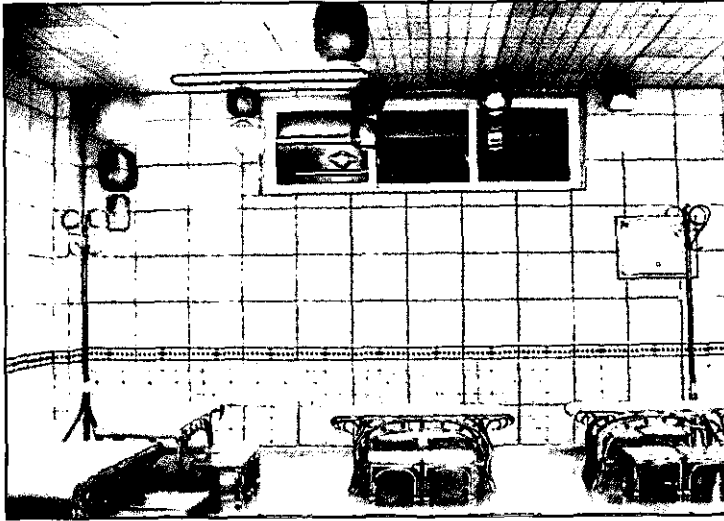
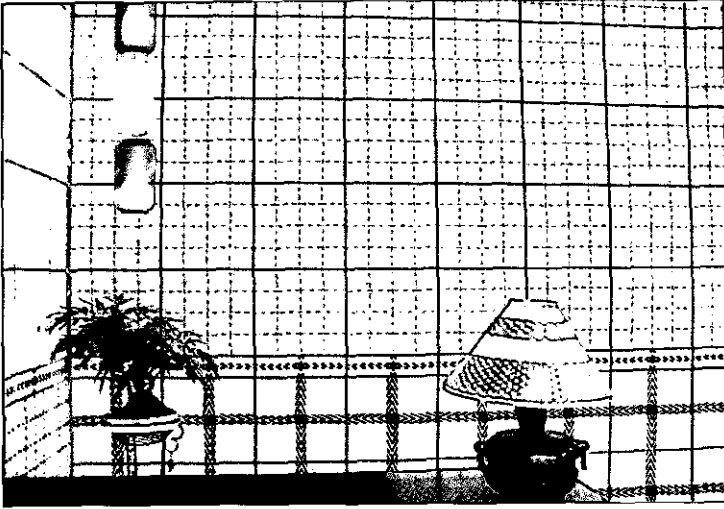
Bamboo mats used in making furniture



Handicrafts made with Bamboo Mat



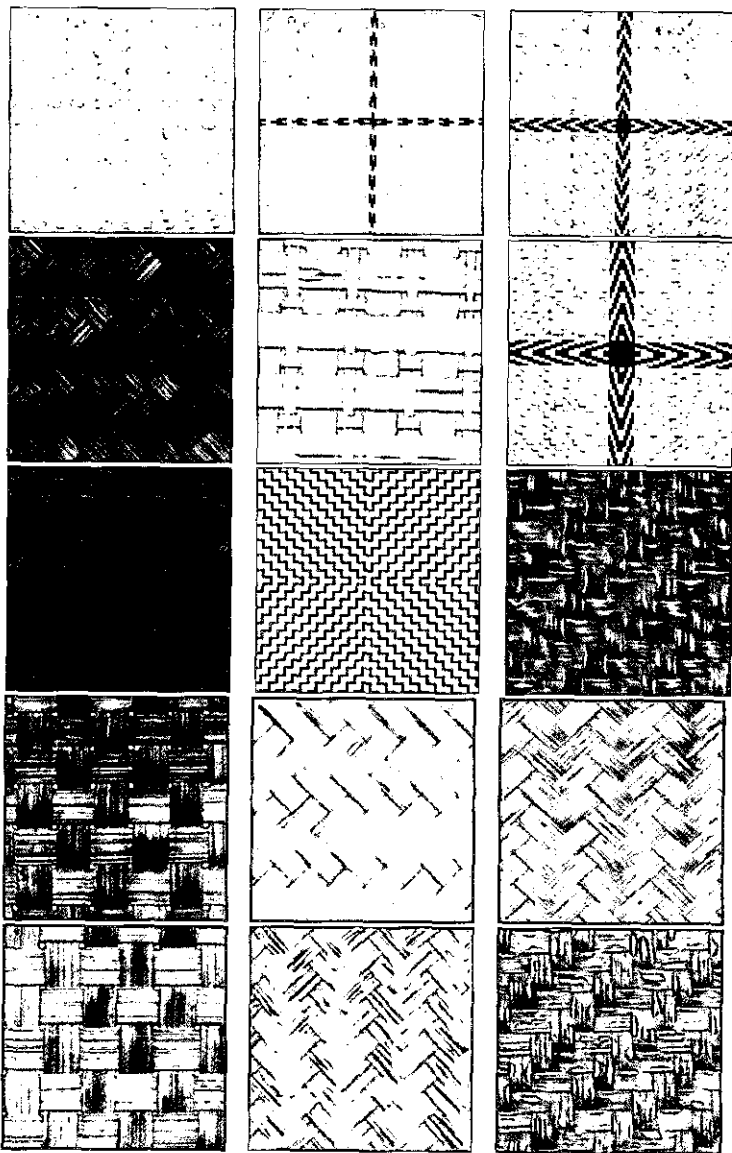
Bamboo Mats for Wall Paneling



Bamboo Mat Panels or "Wall Paper"

II. BAMBOO MAT DESIGNS AND PATTERNS

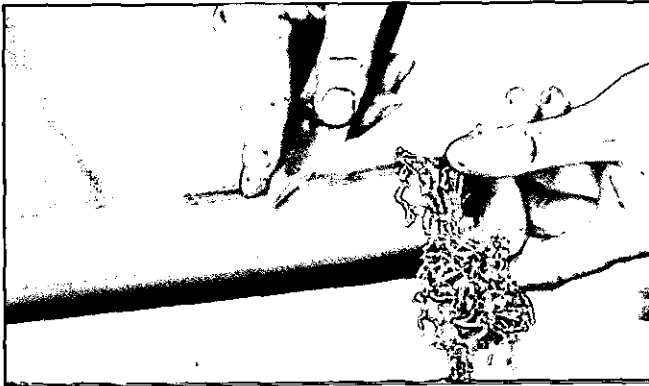
Below are some samples of bamboo mat designs and patterns.



III. PRIMARY PROCESSING OF MATERIALS

A. *Seven Steps of Primary Processing*

There are 7 steps in the primary processing of materials needed for weaving bamboo. These are shown in the pictures below and will be explained step by step in the next section.



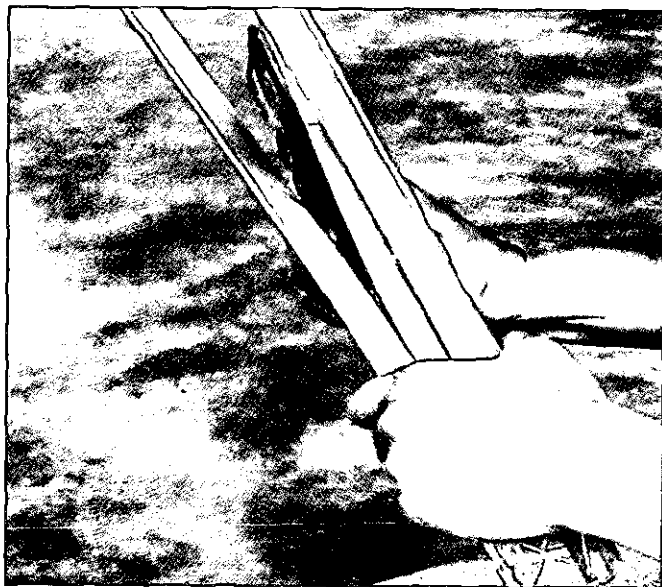
Step 1: Scrape off the green skin of the culm



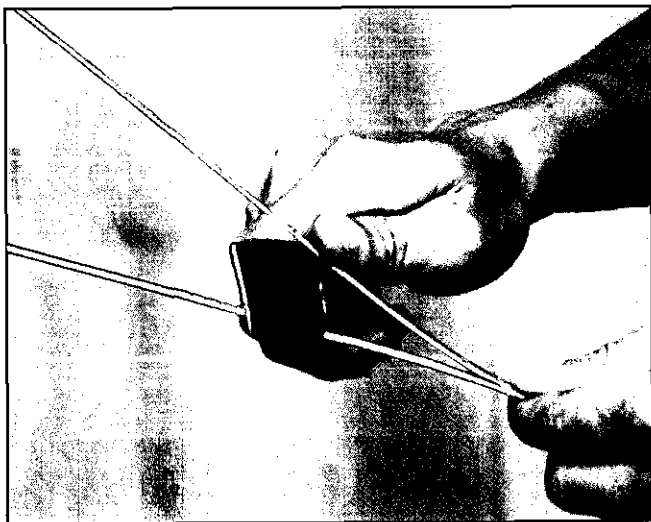
Step 2: Flatten the edge of the culm



Step 3: Divide the culm into slivers of an equal width



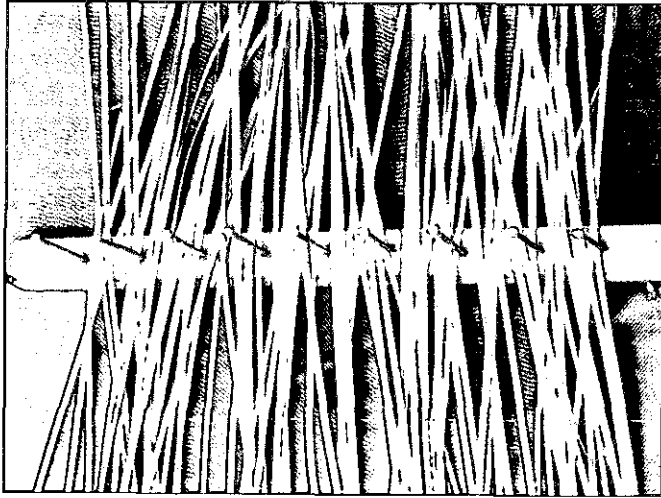
Step 4: Separate the slivers



Step 5: Cut the slivers into fine layers



Step 6: Separate the layers into fine strips



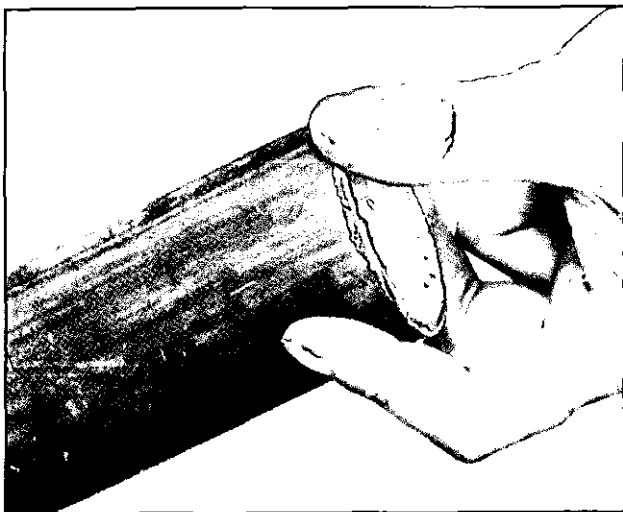
Step 7: Classify and group the strips by color

B. Removal of Bamboo Skin

Removing the green skin of the bamboo culm is the first step in the primary processing of materials required for woven bamboo products.

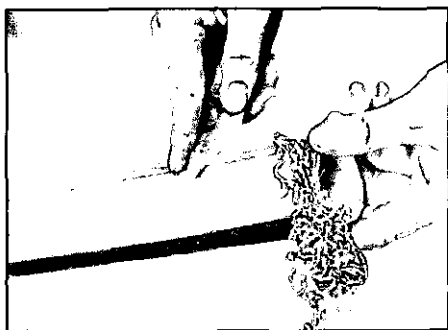
Removing the green skin involves scraping off the green colloid on the surface of bamboo culms as follows:

1. Place a section of bamboo culm at the angle of 45° on the ground
2. Press your thumb of the left hand on the edge that has been sawed, and use your first finger and second finger to hold the section. Three fingers should be placed in the shape of a triangle to increase the stability.

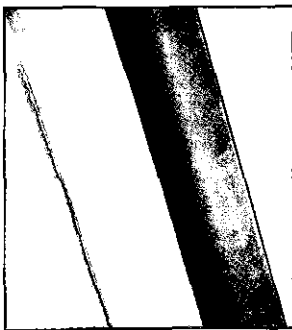


The right way of holding bamboo

3. Slide the blade in a downward motion along the culm section without scratching the skin; then position the blade to scrape the skin in an upward motion along the culm section.
4. In other words, the technique involves sliding the blade downwards and scraping upwards.
5. When scraping the skin, apply force evenly along the culm surface in order to ensure a uniform color.



The right way of scraping



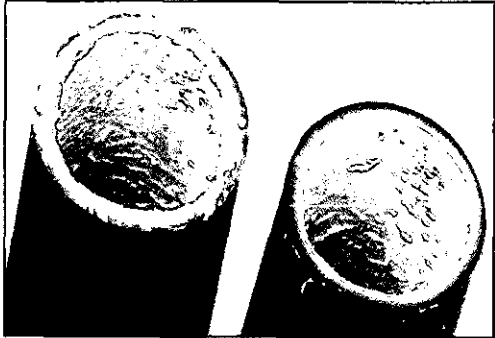
Before and after

C. Edge Flattening

After removing the green skin, the next step is to flatten the edge of the culm section to facilitate stripping. To do this, hold the bamboo section firmly, and use a sharp knife to cut evenly around the edge so that it becomes flat and smooth.



Flattening the culm edge



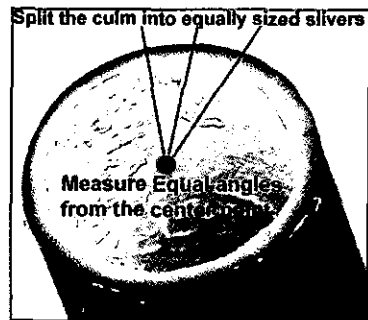
Before and After flattening

D. Dividing the Culm Sections into Slivers

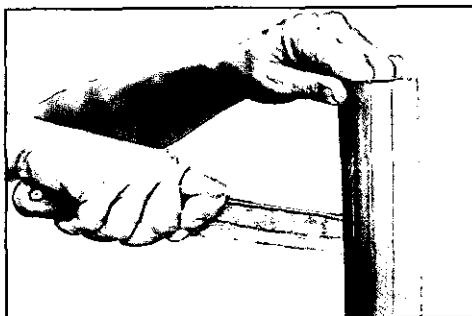
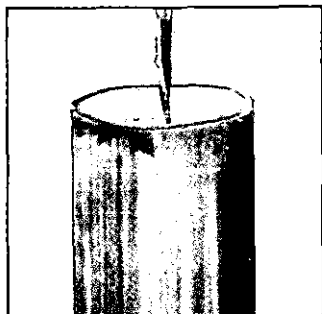
The next step is to divide the culm section into slivers of an equal width.

The number of slivers will depend on the diameter of the culm. It is important that the slivers are as flat as possible.

1. Before cutting measure equal sections that cross the central point of the culm section.
2. Each section should be divided at equal angles from the center of the culm to the edge. This method will help ensure that the culm is split into slivers of the same width.



3. Cutting should be done carefully from the edge downwards along the length of the culm section.

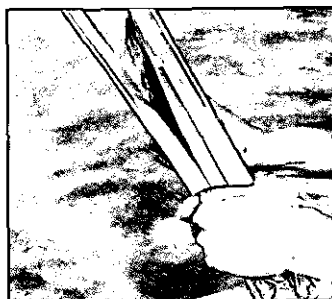


Splitting the culm section into slivers

E. Separating the Slivers

After the culm has been divided, the slivers should be completely separated into individual pieces.

This should be done carefully in order to have slivers of a uniform width.



F. Cut the Slivers into Fine Layers

The next step is to strip the slivers into fine layers.

1. Hold the sliver using your thumb and index finger about 1 cm away from the flattened edge.
2. Hold the knife with the blade horizontally against the upper 1/3 of the cross section sliver.

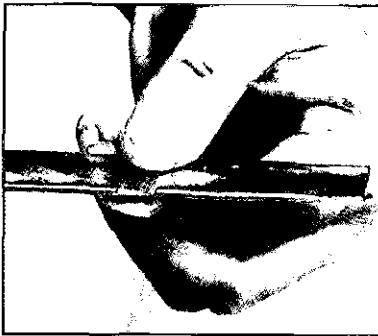
3. Make the first cut by nipping the blade into the sliver, as shown in the image to the right.



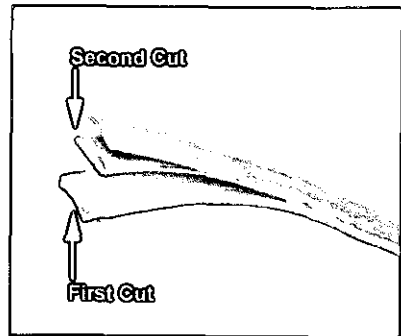
The 1st Cut

4. Be very careful in manipulating the knife. Your fingers can be easily injured if you cut too deep into edge of the sliver.

5. Press the bamboo sliver firmly, and twist the knife to cut the first layer.
6. Position the blade 0.5 mm to 1 mm away from the first layer along the radian in order to cut another layer of an equal thickness as the first one.



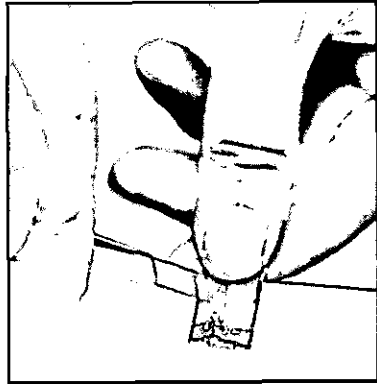
The 2nd cut



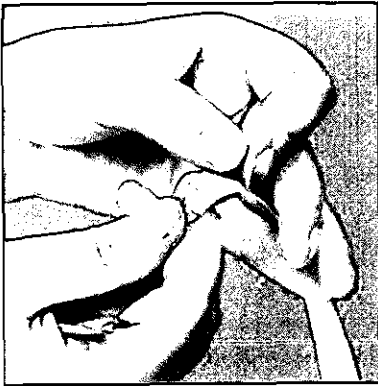
After the first two cuts

7. Hold the layer for further stripping; keep the end without flattening upwards; and use your thumb and index finger to twist the front 2cm to make it soft.
8. Make a cut 2cm into the sliver and then carefully peel off the first layer with measured force in order to avoid breaking it.
9. Strips will be thicker if the cut is deep, and strips will be thinner if the cut is shallow. The thickness of the strips need will depend on the requirement of the woven products.

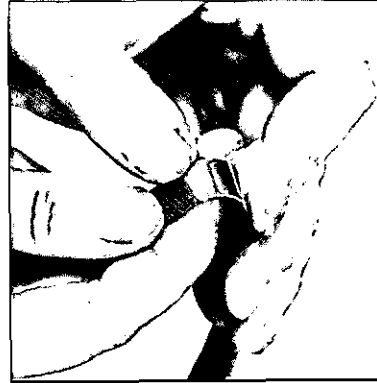
Cutting the sliver
4 times makes
5 thin layers



Make cuts into the sliver



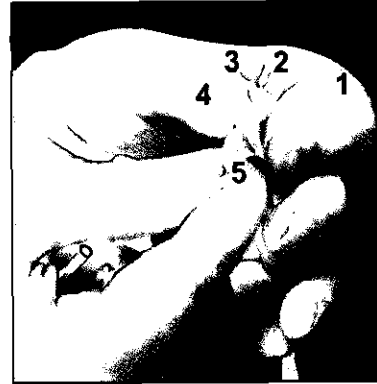
After the 1st cut



After the 2nd cut



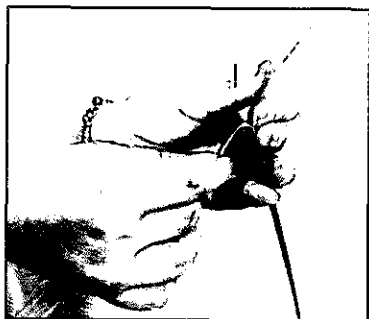
After the 3rd cut



After the 4th cut there are 5 layers

G. Separate the Layers into Fine Strips

1. In order to strip the layers without breaking them:
 - Pay attention to the coordination between left hand and right hand in stripping, the angle of the index finger of the right hand in pressing.
 - Make sure that the cut length of each layer protrudes by about 2 cm in order to have a firm grip and separate each layer properly.
2. Separate the layers using 2 hands:
 - Use the thumb and the index finger of **left hand** to hold the 4 layers together and pull them.
 - Use the thumb and the index finger of **right hand** to hold the fifth layer, and the middle finger and the little finger to hold the bottom part of the strip to adjust the direction during stripping.



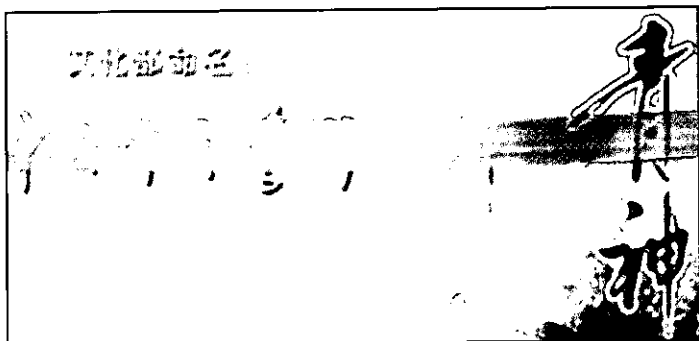
Stripping with both hands



Use 4 fingers

3. Use 4 fingers to separate the layers into fine strips as follows:
 - Hold the 1st and 2nd layers using the index finger and the middle finger of the left hand.
 - Hold the 3rd and 4th layers using the thumb and the third finger of the left hand.
 - Hold the bottom part of the strip with the right hand.

- Simultaneously move the left hand downwards and the right hand upwards to strip the layers.



A very fine bamboo strip can be translucent!

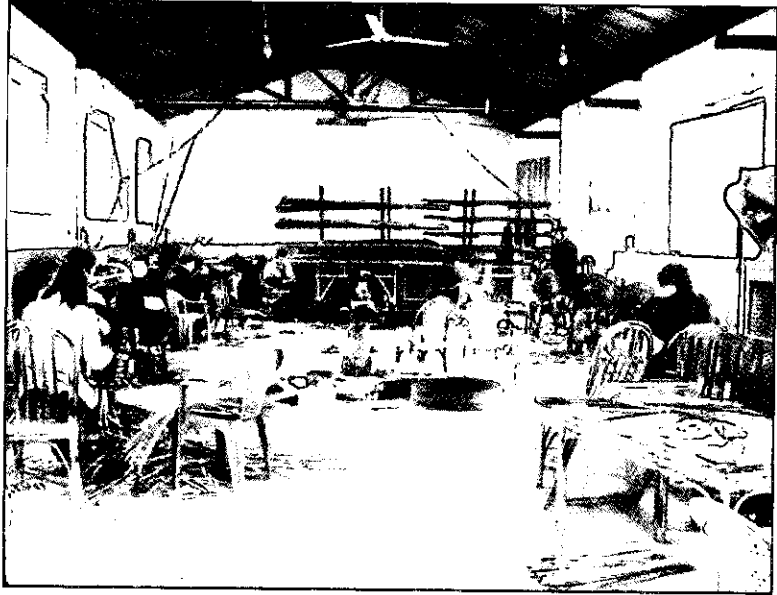
H. Classifying the Strips by Color

1. After making the strips arrange them properly
2. Some strips may be lighter or darker than others.
3. Separate and classify them according to their color.



IV. MACHINE STRIPPING

The process of bamboo stripping can be achieved more rapidly with the aid of special machinery as shown below.



For a large scale production, machine stripping is done in a workshop with several machines as shown in the photo above.

V. SECONDARY PROCESSING

A. Bleaching

Bleaching bamboo strips can be achieved by several methods as discussed below.

1. Sulfur Smoking Method

- Choose a place far away from households.
- Cover the bamboo strips using a plastic sheet.
- Burn the sulfur in a bowl (wear a mask during the operation) and cover the fire so that only smoke come outs.
- Put the bowl under the plastic sheet with the bamboo strips.
- Immediately seal the plastic sheet using mud and allow the smoking process to continue for 12 hours.
- Open the plastic sheet and fan out the smoke, and then take out the bamboo strips.
- The result of the bleaching is directly affected by the size of the covering area, the amount of bamboo strips and the burning condition of the sulfur.

2. Hydrogen Peroxide Soaking Method

- Mix 30% hydrogen peroxide (H_2O_2) solution with water using a proportion of 1:2 (e.g. 1 liter H_2O_2 for every 2 liters of water).
- Dip bamboo strips into the mixture and allow them to soak.
- Use bricks to hold down bamboo strips in the liquid to prevent them from floating.
- Allow the strips to soak for 24 hours and then wash them with water.
- Dry the strips in a shaded area.

3. Hydrogen Peroxide Boiling Method

- Mix 30% H_2O_2 solution with water using a proportion of 1:3, (e.g. 1 liter H_2O_2 for every 3 liters of water).
- Dip the bamboo strips into the mixture and boil the mixture for approximately 30 minutes, or until they are fully bleached.
- Use bricks to hold down bamboo strips in the mixture to prevent them from floating.
- During the boiling process turn the strips over twice so that both sides of the strip are bleached properly.
- After bleaching, wash the strips with water.
- Allow the strips to dry in a shaded area.



Heating Tank for H_2O_2 Bleach



Boil strips in H_2O_2 mixture



Washing Dyed Stripes



Air Drying Strips

4. Other Chemical Methods

Bamboo strips can also be bleached with other chemical bleaching agents. If other chemical methods are used, follow the instructions provided by the manufacturer of the bleaching agent.

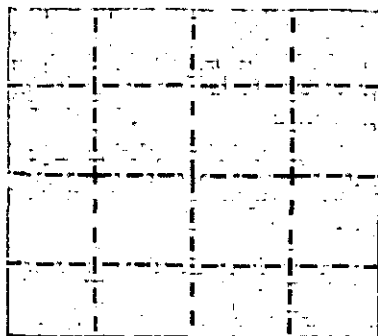
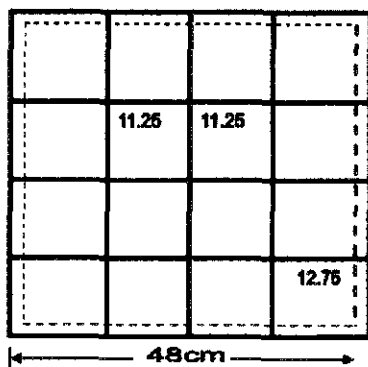
VI. WEAVING BAMBOO MATS

A. Preparing the jig

The size of the jig depends on the size and design of the weaving pattern, but it is usually determined by the length of the internodes of the bamboo species that is used for making the strips.

In China, when *Neosinocalamus affinis* is used for mat making, 2 sizes of jigs are generally used in mass production. The regular jig size is 45cm x 45cm (48cm x 48cm after putting the finishing edge). A larger size of 250 cm (length) * 130 cm (width) is also used.

The jig is usually made of plywood with the thickness of 9 mm.

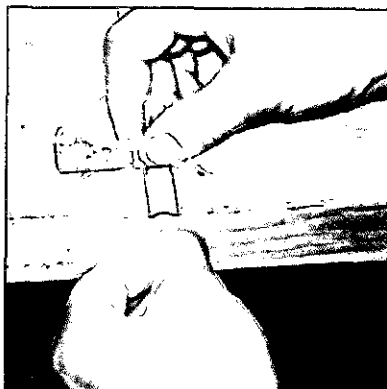


Above: Mold size of 45 cm x 45 cm. Note that a 1.5 cm allowance on each edge makes the total size 48 cm x 48 cm.

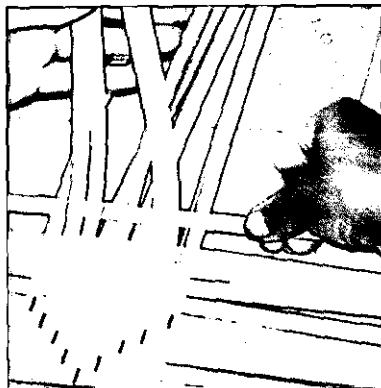
B. Weaving Techniques

The pattern and the color of bamboo mats can be selected and designed according to the preferences of customers. Bamboo mats have to be woven strictly in accordance with a predefined pattern in order to achieve the desired ornamental effect.

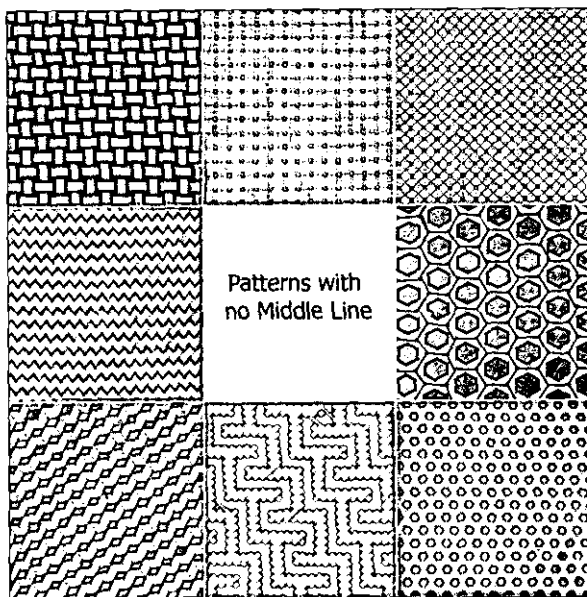
- The first step, prior to weaving, is to make sure that all the strips have the same width.
- Use a needle row to even the width of all the strips.
- Place 9 strips on the desk vertically and hold them on the desk with a steel rod.



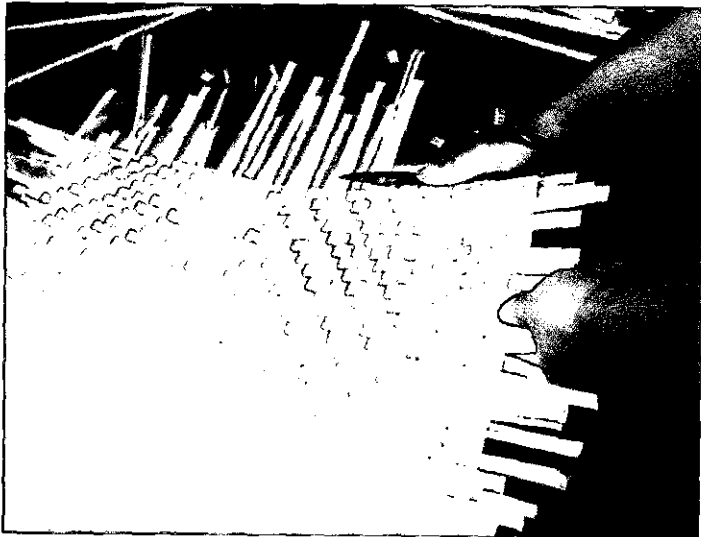
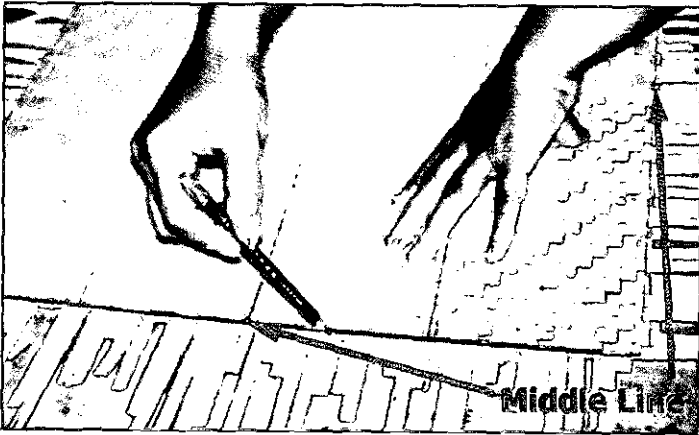
- Insert one strip horizontally under the vertical strip in the middle, and then insert the horizontal strip under two vertical strips after every two strips. Usually second horizontal strip determines the direction of the pattern, so special attention should be paid to the second strip.



- Note that the above mentioned procedure only applies to patterns that have a middle line.
- Some patterns, such as those in the image below, have no middle line. The placement of strips will therefore depend on the particular pattern.



- When the weaving is finished, measure the standard sizes of the mat by using the jig, and then cut off the extra edges, as shown below.



Cutting off edges



A batch of bamboo mats

C. Large Bamboo Mats

Large size bamboo mats need to be made on big working tables. The strips need to be connected together during weaving to lengthen and widen the size of the mat.

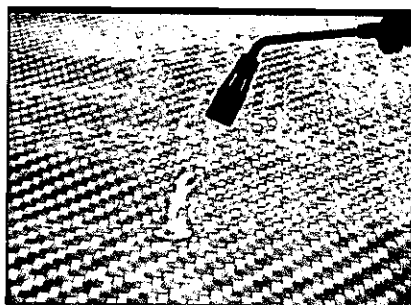


Production of large bamboo mats

VII. FINISHING BAMBOO MATS

A. *Smoothing*

- Machine made bamboo strips are generally more bristly or thornier than the hand stripped ones.
- After the mat has been woven, use a torch to burn off bristles and extra fibers to make the mat smooth. The fire needs to be carefully adjusted such that only protruding fibers are burned, but not the mat. Use a strong flame and sweep it over the surface very quickly to avoid burning and discoloration of the mat.

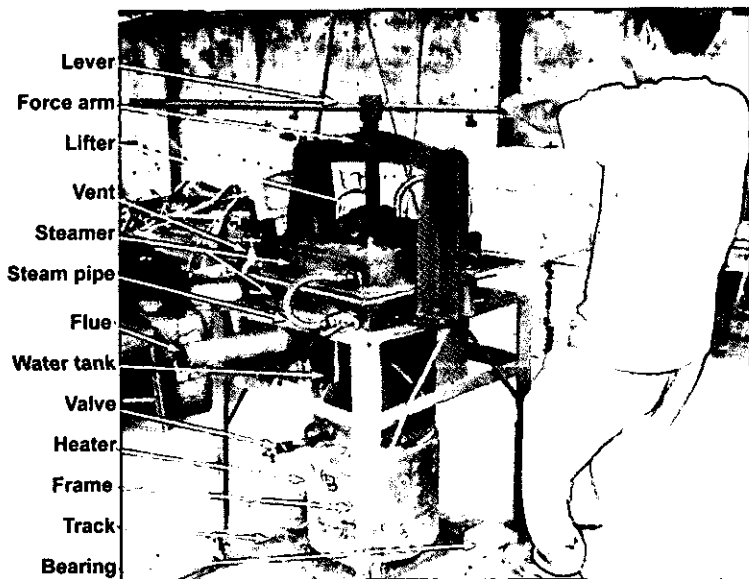


B. *Hot Pressing*

Hot pressing usually involves very expensive equipment. However, for a small workshop, it is possible to use a self-assembled manual pressing machine.

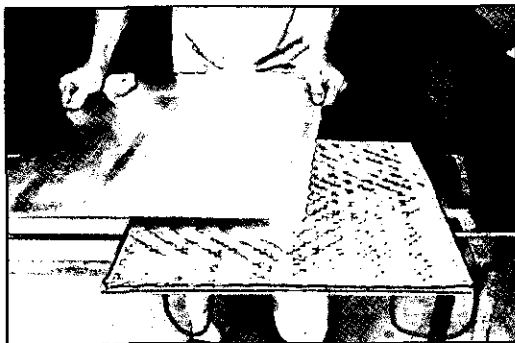
A self assembled pressing machine costs a fraction of an electronic hot pressing machine.

The productivity of such a machine is about 56 mats per hour.

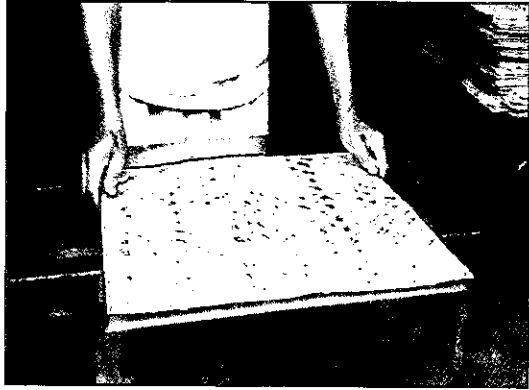


A self-assembled Hot Press

- To press 4 mats simultaneously, prepare 5 pieces of armor plate (3 mm thick) to separate each mat.



- The 4 mats should be sandwiched by the 5 armor plates.

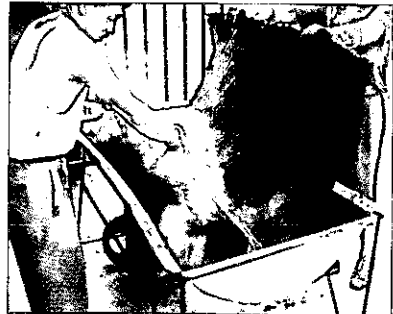


- Pre-heat the machine to 100°C.
- Place the armor plates and mats into the machine.
- Press for 3 minutes.



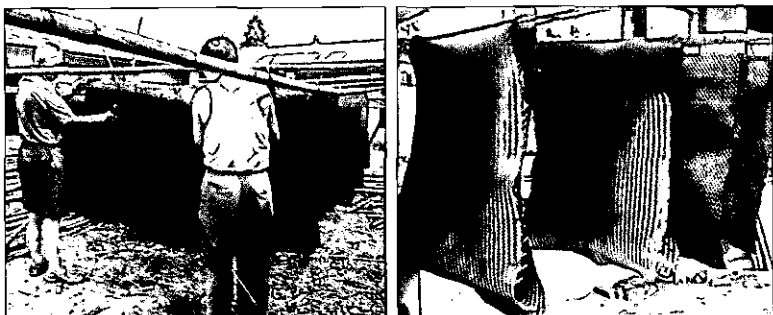
C. Dyeing

- Boil water to 50°C and then mix the dyes into the water until the required color is obtained.



- It is quite difficult to obtain the exact same color every time. It is

therefore advisable to dye as many pieces as needed at one time.



- When the batch of mats has been colored, hang them out to dry.

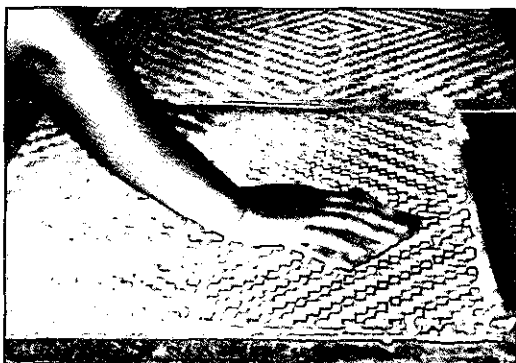
VIII. REFINING MATS FOR USE AS WALL PANELS

Bamboo mats can be used as wall panels. Some refinements are usually required for this application. The most common refinements involve painting, sanding, and foam backing.

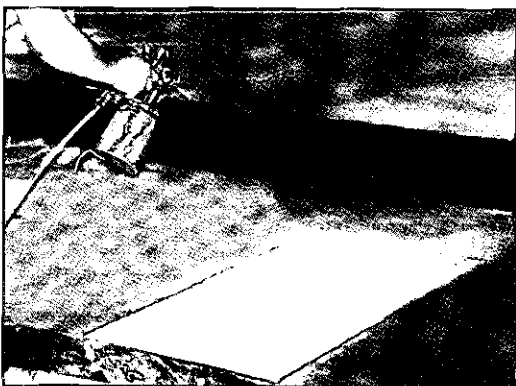
- To paint the mats you will need a polyester paint, a good working table, a paintbrush. Work in a well ventilated area and wear a face mask to limit the paint fumes inhaled.
- Paint both sides of bamboo mat evenly using polyester paint.
- Apply 2 coats of paint if necessary.



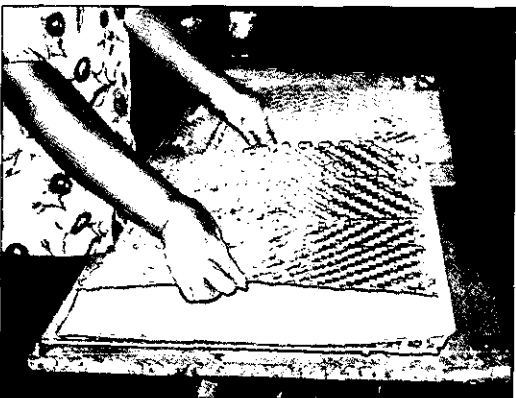
- When the paint has dried, sand the mats using very fine sand paper until they are smooth.



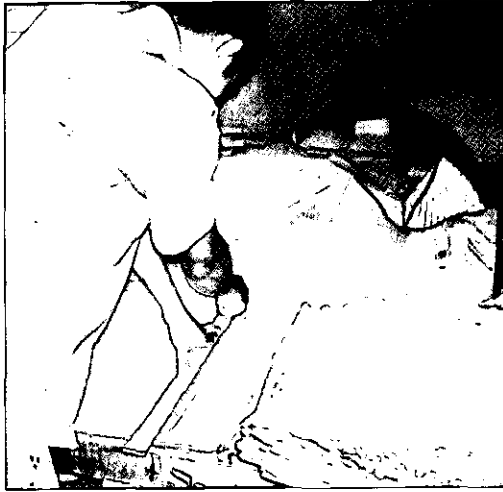
- Apply glue to the back of the mat, if possible using a compressor spray.



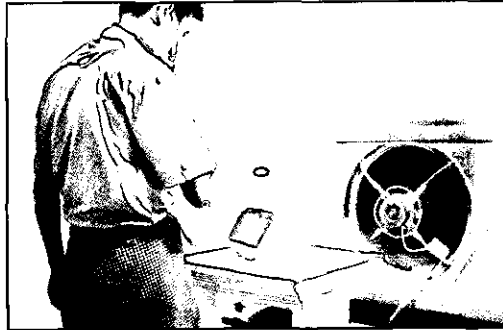
- Stick the bamboo mat to a 2mm thick piece of foam.



- Cut off the edges so that a standard size is obtained for all mats.



- After cutting the mats into the standard size, the wallpaper will be sprayed with finishing paint.



- Allow the painted mats to dry in a shaded and dust free area.



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