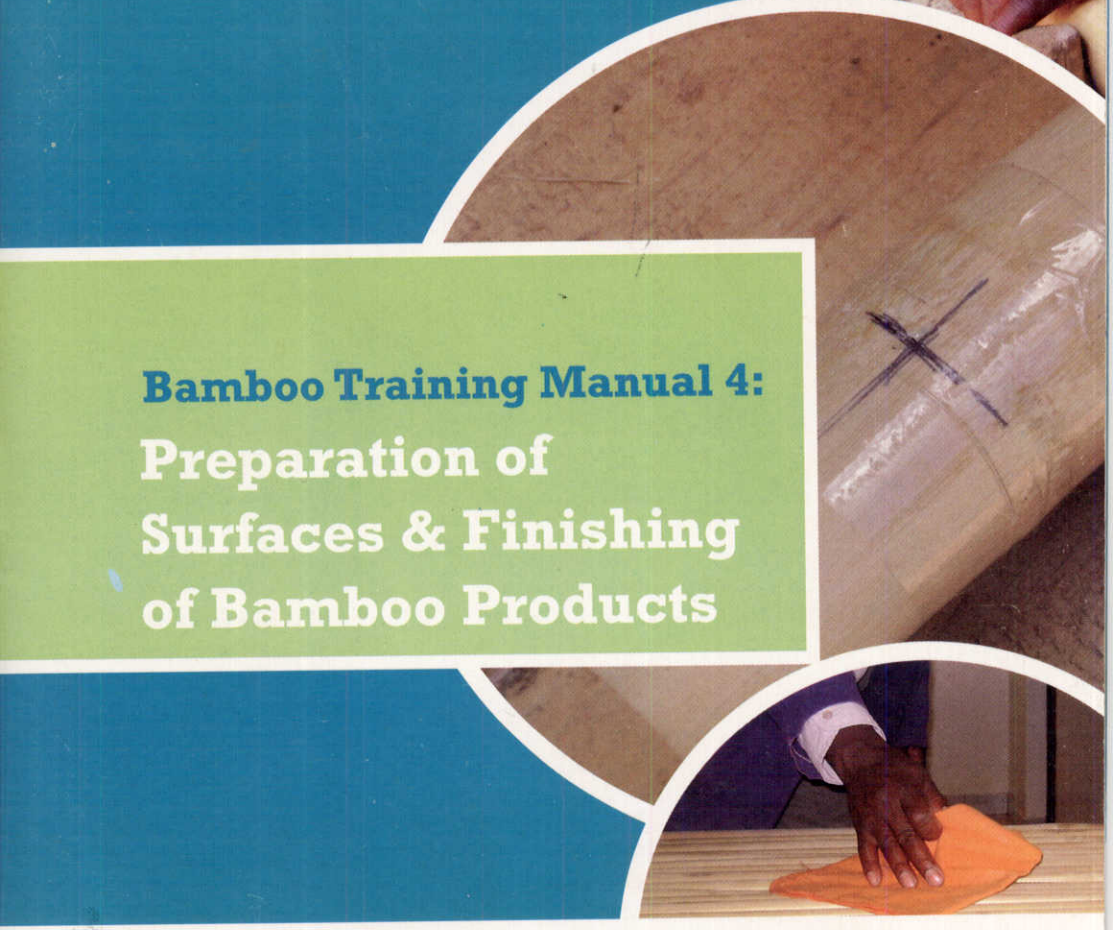
BamCraft – Crafting a Green Future: Bamboo in the curio and souvenir industry of Kenya



Bamboo Training Manual 4:

Preparation of Surfaces & Finishing of Bamboo Products

Funded by:

Government of Japan

Executed by:

United Nations Industrial Development Organization

Implemented by:

Kenya Forestry Research Institute

BamCraft – Crafting a Green Future: Bamboo in the curio and souvenir industry of Kenya

KENYA FORESTRY RESEARCH INSTITUTE
LIBRARY
P.O. BOX 20412, NAIROBI.

Bamboo Training Manual 4:

Preparation of Surfaces & Finishing of Bamboo Products

Funded by:

Government of Japan

Executed by:

UNIDO

United Nations Industrial Development Organization

Implemented by:

KENYA FORESTRY RESEARCH INSTITUTE KEFRI

Kenya Forestry Research Institute

This project is being financed by the Government of Japan, executed by United Nations Industrial Development Organization, and implemented by the Kenya Forestry Research Institute.

Copyright ©2012 by the United Nations Industrial Development Organization.

First published in 2012.

This manual is based on the work of Mr. Mark Dreyer, UNIDO Consultant, in cooperation with the project team and under the supervision of UNIDO Project Manager: Mr. Frank Hartwich.

Designations employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations Industrial Development Organization (UNIDO) concerning the legal status of any country, territory, city, or area, or of its authorities or concerning the delimitation of its frontiers and boundaries. The opinions, figures and estimates set forth are the responsibility of the authors and should not necessarily be considered as reflecting the views or carrying the endorsement of UNIDO. The mention of firm names or commercial products does not imply endorsement by UNIDO.

This document has not been formally edited.

CONTENTS:

Introduction

This booklet is the fourth in a series of training manuals prepared as part of the BamCraft project in Kenya. It is intended for those interested in making use of bamboo as a wood substitute for building finely finished products and structures. It is a follow up to ***Bamboo Training Manual 1: Bamboo Harvesting and Preservation*** *and* ***Bamboo Training Manual 2: Processing Round Pole Bamboo.***

Before pursuing any project shown in this booklet, the reader is strongly advised to learn and apply the basic methods of bamboo preservation and processing, as described in the aforementioned publications.

This manual deals specifically with the preparation of furniture surfaces and their finishes. It explains basic concepts and techniques which should enable the reader to transform the acquired knowledge into practice. The instructions are illustrated and provide a quick and easy introduction to the methods used for finishing bamboo surfaces, which are similar in many respects to those used in the treatment of wood.

All steps for finishing bamboo products are described using a simple design example. The techniques that are described herein are applicable to a vast array of other

bamboo products.

The method starts with the proper material selection and marking of parts and goes on to explain grinding and sanding processes and assembly techniques. Some tips are provided on finishing touches, including the use of different colors and materials for embellishing the final products.

It is hoped that the information provided herein will encourage the reader to work with bamboo and develop skills to become a fully-fledged bamboo artisan.

Product Example: Three Layer Shelf

To demonstrate the principles and techniques for the preparation of surfaces and finishing of round pole bamboo products, we shall focus on a fairly simple product, namely, a three layer shelf.

More complex bamboo products can later be made by applying the methods explained in the following pages.

Tools & Materials:

- Scrubbing pad
- Big knife
- Sanding paper (P80, P120, P180, P240)
- Saw
- Measuring tape
- Pencil
- Rubber eraser
- Clamps
- Ropes
- Chisel
- Drilling machine
- Drill bits
- Hole saw
- Half round file (fine)
- Half round file (rough)
- PVAC glue (incl. brush)
- Leather strips (for decorative binding)
- Mitre Box
- Contact glue (for leather)
- Clear (transparent) Tape

BAMBOO MATERIAL PREREQUISITES

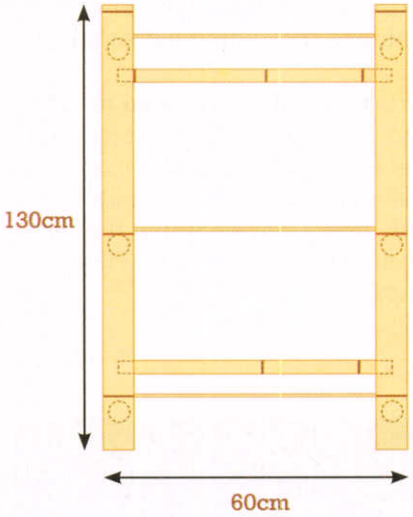
All bamboo culms to be used should be:

- Well preserved (using borax treatment method).
- Well dried and without cracks.
- Cleaned using a scrubbing pad.

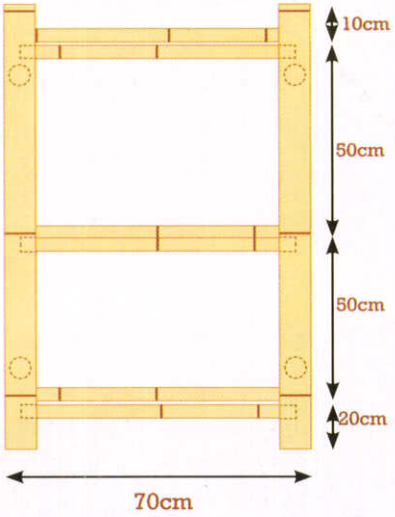
Cut list for a 3 layer shelf

	Function	Width (cm)	Diameter (cm)	Quantity	Length (cm)	Total (m)
1.	legs	-	6.0	4	125	5.00
2.	Rails	-	3.0	6	60	3.60
3.	Side Rails	-	3.0	4	70	2.80
4.	Splits	3.0		50	70	35.00
5.	Covers	-	3.0	6	60	3.60

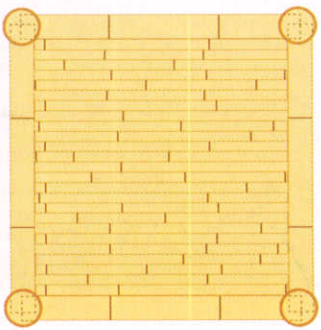
Front View:



Side View:



Top View:



STEP 1

- Select treated bamboo culms according to the cutting list and final use.
- All parts that will be exposed to view need to have an excellent surface, i.e., without marks, stains, or defects.
- If some materials have noticeable defects, find a way of hiding them by positioning the pieces so that they are not visible.

STEP 2

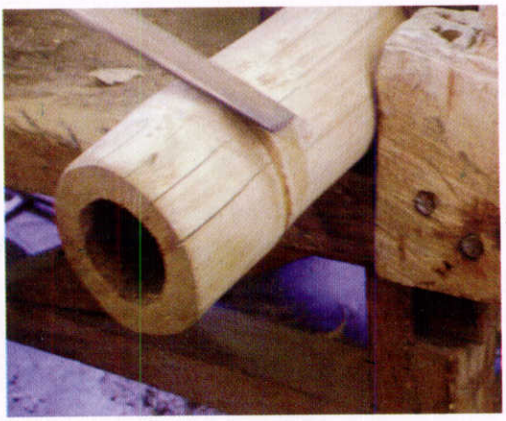
- Carefully scrape off the outer skin of the bamboo using a knife.

STEP 3

- When scraping the outer skin, position the knife at approximately 90° relative to the culm. This facilitates the scraping process and minimizes the risk of damaging the culm with deep cuts.

STEP 4

- Clean the recessive areas of the nodes using a half round fine file.



SANDING

GENERAL INFORMATION:

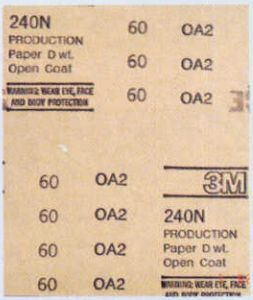
- Sanding is actually a cutting process. The abrasive particles of sandpaper work like tiny cutters that remove small amounts of material from surfaces. When sandpaper is used for finishing bamboo products, the overall effect is the smoothening of the surface.

The process involves using various grits of sandpaper, starting with rough paper and gradually to the finer ones.

- Using only very coarse sandpaper will leave sanding marks that lower the quality of the product.
- Start sanding with 80 grit sandpaper to remove the marks that were made from scratching outer skin with knifes and cleaning the nodes with the half round file.
- Continue sanding all surfaces with 120 grit sandpaper until all the sanding scratches created by the 80 grit have been removed.
- The next step is to sand the surface with grit 150 and finally with 180 grit paper.
- Do not skip a grit number in your sanding procedure. To produce a smooth surface you need to be systematic by gradually using finer grits of sandpaper. Otherwise it will be very difficult to eliminate rough spots.
- Use a damp sponge to wipe the surface. This will raise loose fibers, which will cause problems when finish (e.g. varnish) is applied. After the surface has dried, use a sanding block and sand all areas again with 180 grit paper.

Grit Size of Sandpaper:

- The grit size determines the relative diameter of each abrasive particle.
- The grit number is printed at the back of the sandpaper sheet.
- The larger the grit size, the finer or smaller the particle size. For example, a grit size of P220 grit is finer than P100.
- The larger the particles, the faster the abrasives will remove the material. They also leave deeper scratches on the surface.
- Small particles produce a smoother surface. But if you sand the bamboo at a slower rate you might not be able to remove deep scratches.



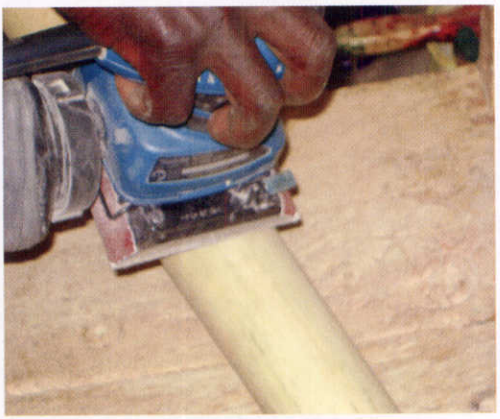
Grit 60 sandpaper

Grits for abrasives used for bamboo and wood working:

- P40 to P800 abrasive paper are usually available in hardware stores.
- P40 is too rough for normal woodwork especially for hand work.
- P60 is commonly used on wide-belt sanders for very rough sanding.
- P80 is recommended as a starting size for handwork with bamboo material (Use of an orbital sanding machine only with this grit size.)
- P80 up to P180 is used for basic sanding of raw material.
- P180 up to P400 is used for the fine sanding of finishes.
- P600 to P1200 is only used for polishing high gloss surfaces.

STEP 5

- Sand the surface of the bamboo material in order to create a smooth surface.
- Any superficial marks will reduce the quality of the final product.

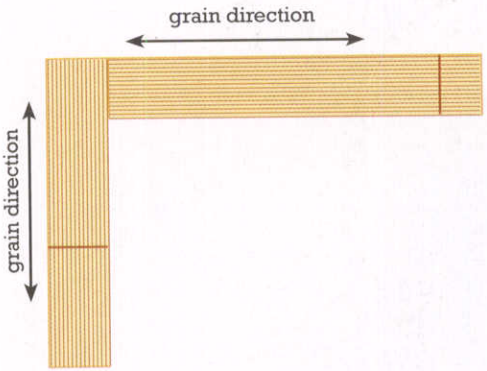


STEP 6

- Most of the sanding work should be done before the final assembly of the product.
- It is easier to sand all parts before assembly and it is also possible to use sanding machines. After assembly, sanding becomes more difficult and some areas of the product are not easily accessible.
- Sanding has to be done to remove marks and fibers still standing out of the surface of the material.
- Use an orbital sander only on the first pass.
- Regularly check the results of the sanding process and proceed according to your observations.

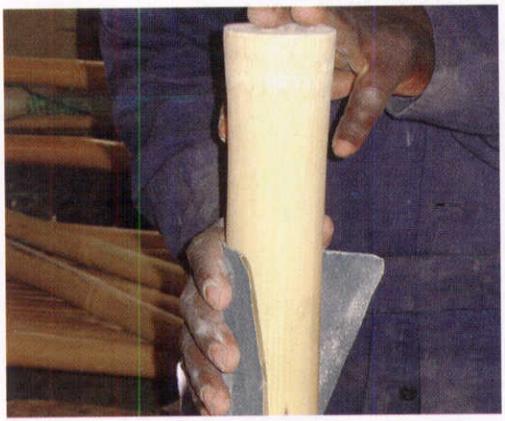
STEP 7

- Hand sanding is necessary because of the oriented fibers of bamboo material.



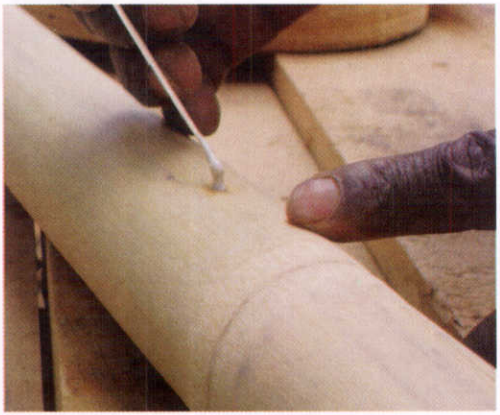
STEP 8

- Attention: sanding across the grain will leave marks which are difficult to remove.



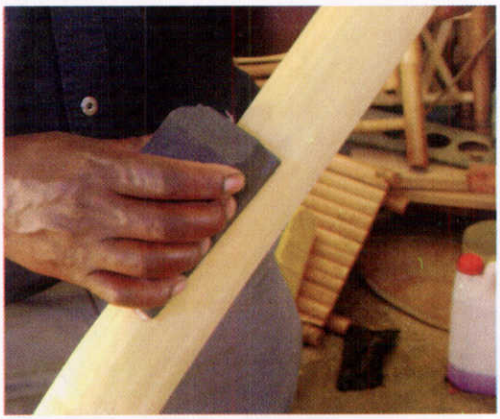
STEP 9

- In subsequent passes, sanding has to be done without an orbital sander and in the direction of the grain.



STEP 10

- Holes or other defects can be remedied using putty filler. You can make your own putty if you take very fine sanding dust from your product and mix it with a nitro cellulose varnish (or white glue).
- Apply the filler into the holes or cracks. Allow the putty to dry and then sand off the excess putty.



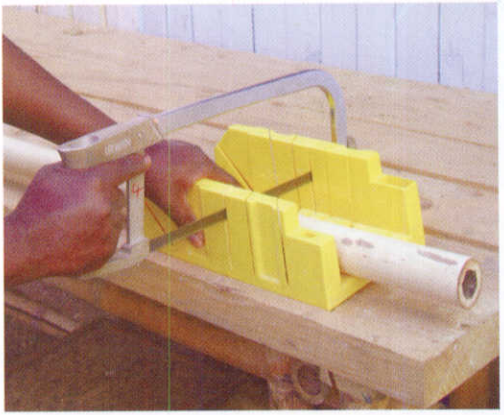
STEP 11

- Use sanding blocks to ensure that the surfaces of round work pieces are evenly and smoothly sanded.

Sanding block

STEP 12

- Saw pieces according to the final length mentioned in the cutting list. Before sawing apply clear tape around the sections to be sawn. This will help you achieve a cut without loose fibers. Use a mitre box so that pieces are cut at the required angle.
- After you have sawn the pieces, repeat the sanding process over the cross section using a hand block to ensure a flat edge.
- Attention: if a hand block is not used there is a high risk that the edges will be rounded, and this is not desirable.



STEP 13

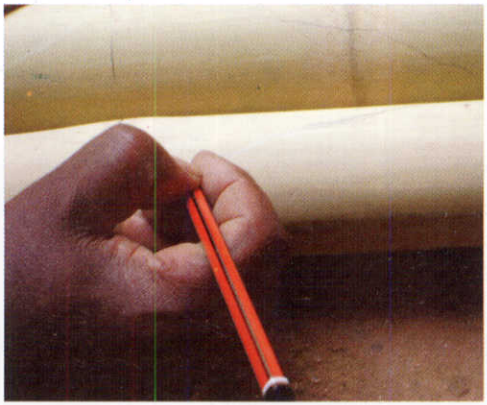
- Wipe the surface with a humid sponge before the last pass. This will cause loose fibers to rise from the surface. Sand again with a very fine grit to eliminate all loose fibers.

ASSEMBLING

Assembling any product requires good organisation and a systematic workflow. The assembly of the 3 layer shelf involves the arragement of pieces, clamping on the work bench, drilling & connecting, gluing the frame and fixing the strips.

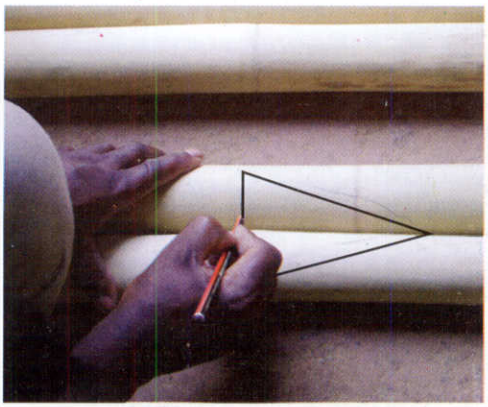
STEP 14

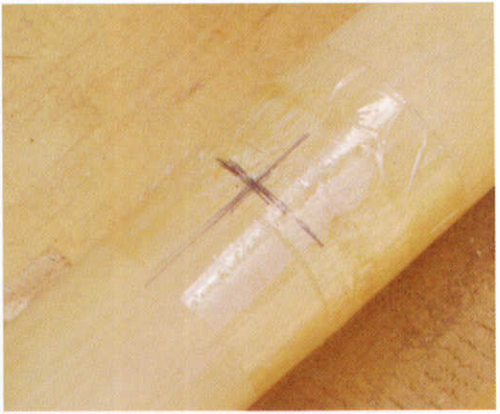
- Use a pencil to mark all pieces with lines or symbols to facilitate their arrangement and assembly.
- Never use a ball pen or soft tipped pen because the ink is very hard to remove.
- Be careful when using tools like mortise gauges, dividers or awls! Such tools can leave deep marks which are hard to remove.



STEP 15

- Make sure that the best surfaces are facing outward so they are visible from the viewer's perspective.





STEP 16

- After you have marked the spot to drill holes, make use of clear tape to cover the spot. This will prevent loose fibres from rising.

STEP 17

- Always use a workbench.
- Make sure that work pieces are securely fastened while you work on them, especially while drilling holes.
- Use 2 clamps to fix the work pieces to the work bench. Support of clamps is useful to prevent the drill bit from slipping away and damaging the surface.
- Be careful not to damage the work pieces. Protect surfaces by using half round scrap wood.

STEP 18

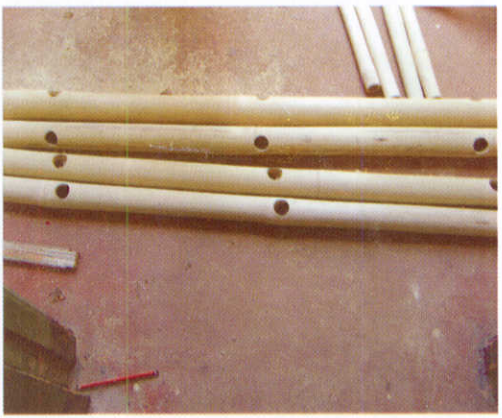
- In order to have a comfortable working environment make sure that clamp handles are positioned below the workbench and are out of the way.
- Ensure that the clamps are properly positioned so that the pieces of bamboo do not slip.

STEP 19

- Before starting to drill, ensure that the drill bit is positioned properly. If it is not centered or is bent it may slip and may damage the surface of the workpiece.

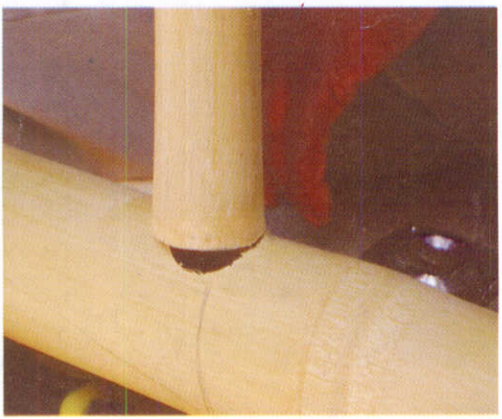
STEP 20

- Assembly has to be done very carefully since the materials already have a nicely sanded finish.
- Put some old fabrics or other soft materials below the work pieces when you are working on a hard surface. Always make sure that the working surface is clean and free of sharp objects.



STEP 21

- Adapt pieces at the connections according to angles and length.

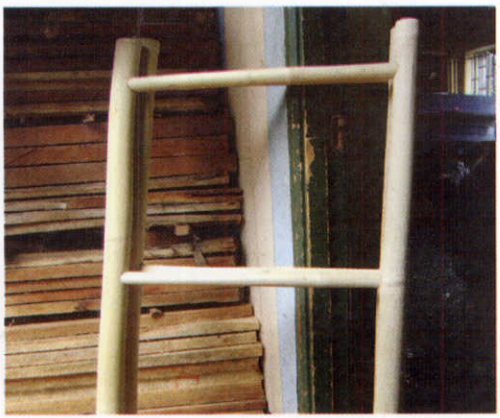


STEP 22

- Adjust the size of holes to the culm diameter using a half round rough file or chisels if necessary.
- Never reduce the culm diameter at the end of the culm to the hole diameter because this can be easily seen and reduces the aesthetic value of the product.

STEP 23

- Check for loose fibers at the connections and remove them.
- Do not hammer culms into the holes because the culms crack easily.



STEP 24

- Whenever you assemble a complex product, get a partner to help you.
- Build main frames according to drawing and dimensions.
- Dimensions have to be checked before gluing.
- Perform a dry run assembly so that all parts conform to the dimensions of the cutting list and that they all fit together properly according to the design.

STEP 25

- Use white glue for standard T-connections (fixing a culm into a drilled hole).
- Before applying any glue, clamping devices or ropes should be ready at hand. The glue has only a limited time before it starts drying!
- Use epoxy glue for special heavy load bearing joints.

STEP 26

- Use ropes to fasten pieces together very firmly so that the glue dries properly.

STEP 27

- Remove white glue stains from the assembly while the glue is still fresh. You can wash it off easily with a damp cloth. Most other glue types cannot be removed after they have hardened.
- Sand the surface after the application of water once again.

STEP 28

- Connect the 2 frames of the shelf with rails according to the design of the shelf.
- Double check that the dimensions are according to the drawing.
- Measure the diagonals between the opposite bottom and top corners of the shelf. Ensure that the diagonal lengths of all sides are equal.

STEP 29

- Use clear tape on points where holes are to be drilled for dowels.
- Drill holes carefully using the correct drill bit size, enabling the firm placement of dowels.

STEP 30

- Drive in the dowels using a mallet.

STEP 31

- Once dowels are inserted, cut off the protruding parts very carefully and precisely. Do not just break off the dowels; be careful not to damage the pieces.

STEP 32

- Arrange the bamboo strips in order to have a nice surface, with an attractive placement of nodal stripes.
- Use a soft pencil to apply marks on each strip to ensure the proper arrangement.

STEP 33

- When drilling holes for fixing the strips be very careful not to drill through the whole culm (prevent holes on the bottom side of the supporting culm).

STEP 34

- Fix the first strip with dowels and white glue.

STEP 35

- Neatly cut off the protruding tip of the dowel.

STEP 36

- Adjust the next strip in order to ensure that all strips are parallel.

STEP 37

- Repeat this step until the whole surface is done.
- Check for any loose fibers, holes or superfluous glue and remove them carefully after you have finished the whole shelf.

STEP 38

- Before varnishing. make sure to remove all pencil marks, preferably using a rubber eraser. Varnish will bring up every pencil mark that is not erased.
- Sand with grit P240 to get a smooth surface, then sand again with P320 to achieve a finer and smoother surface.

STEP 39

- Clean the surface by blowing compressed air or use a piece of dry cloth to wipe away all sanding dust that remains on the assembled product.

FINISHING

Finishing involves colouring, varnishing or oiling by means of brushing or spraying.

COLOURING

BLEACHING: removes the natural color of bamboo. Use hydrogen peroxide which is a chemical product. It is advisable to wear gloves, goggles and a face mask when working with chemicals.

STAINING: creates color through the use of pigments that are dissolved in a liquid. When the stain is applied , the colored pigment remains on the bamboo surface. Pigments for staining are available in powdered form or premixed.

SPECIAL LAYERS

There are special products which are available in different colours that can be applied as a finishing touch before applying the final lacquer coat:

GRAIN FILLER: Is used to create a level surface on bamboo by filling up holes or surface imperfections. You need it for a closed-grain finish. Rub the filler on the bamboo in circular strokes and remove the excess filler with a coarse cloth. Let it harden and sand it slightly with fine grade paper in the direction of the grain.

SANDING SEALER: A barrier of finish designed to seal the substrate and/or increase the adhesion of the next coat. For the clear finish use a sealer; for the pigmented finish a primer is recommended.

VARNISHING

The most suitable finishes for bamboo are evaporative lacquers which are pigment based. These include:

NITROCELLULOSE LACQUER: Very popular finish; dries extremely quickly; forms a hard and very brittle surface, not absolutely scratch resistant. Durable but only moderately resistant to water, chemicals and heat. The finish is clear but will get yellowish after some years. Not environmentally friendly, flammable. Wear goggles, gloves and face mask during use.

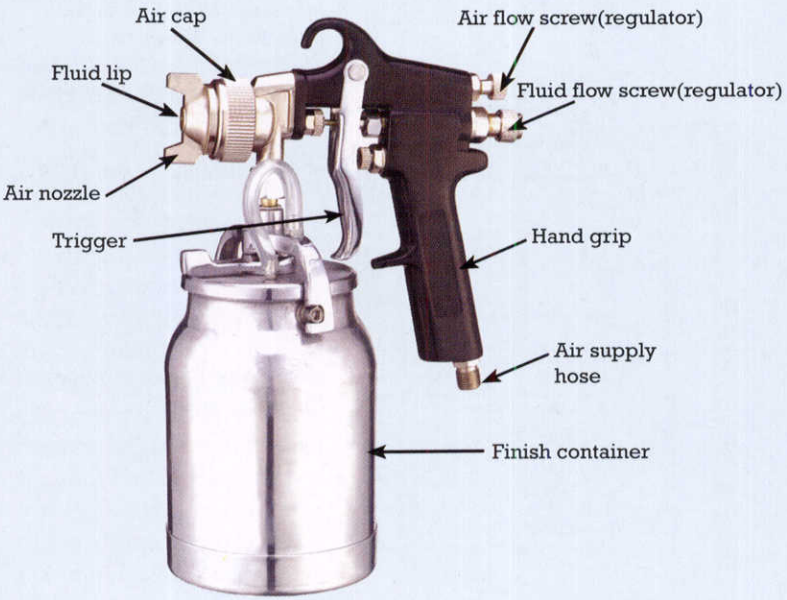
WATER-BASED LACQUER: Thinning solvent is mainly water therefore more environmentally friendly, not flammable. It is easy to use but takes longer to dry. The durability is good, it is also more or less resistant against solvents.

VARNISHING USING A BRUSH

- Check room conditions. Make sure it is a dust free area with good lighting and with a ventillation & exhaust system.
- Spread the varnish as thinly as possible by applying it with the brush moderately to avoid running.
- Pay attention especially to all connections and joints to ensure that there is no excess varnish that may drip.
- After applying the varnish leave the room in order to avoid dust generation.
- Check the surface after it has dried completely.
- The drying time will depend on the type of varnish.
- If too many dust particles remain on the surface repeat the sanding process and paint it again.

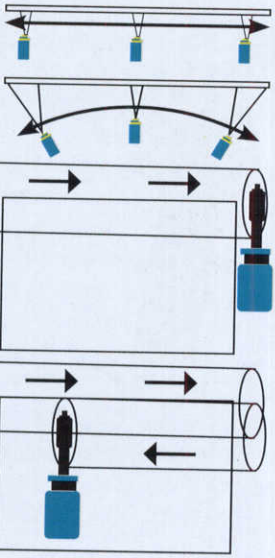
APPLYING A FINISH BY SPRAYING

- Spraying lacquers must be applied with a motorized spray gun and a compressor. For small jobs, lacquer can be applied with aerosol spray cans.
- Pressurized air is used to spray the liquid finish and distribute it in very fine particles on a surface.



spray gun and its parts

- The compressed air flows through the air inlet to the air valve. The air valve will be opened by pressing the trigger. When the trigger is pressed the fluid pin retracts and the finish (lacquer) is sprayed out as a mixture of air and lacquer.
- The fluid and the air flow are regulated by valve screws. The valve screws can be adjusted to regulate the pattern of spraying. Always do a test before you start spraying the product.
- For the different viscosities of your finishes you have to change the fluid tip of the spray gun. Consult the product information about the recommended nozzle spray size.
- Properly clean the spray gun after each use. Cleaning is done by spraying pure thinner. Release the pressure and clean the gun with a rag damped in thinner.
- Always follow the safety instructions when you spray lacquer! Wear goggles, gloves and a face mask.
- An exhaust system is required when spraying otherwise the overspray will destroy your newly finished surface.

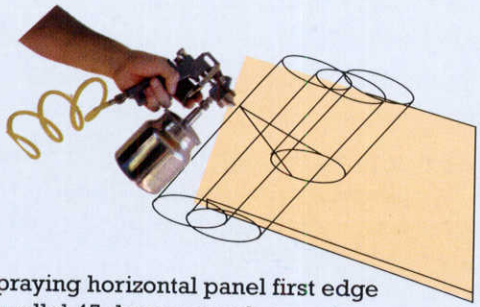


move spray gun on a path parallel to the work

swinging the gun produces uneven coverage

start and finish of the work

overlap previous application on return pass



spraying horizontal panel first edge parallel,45 degrees work away from you

Adjustment of Air Nozzles

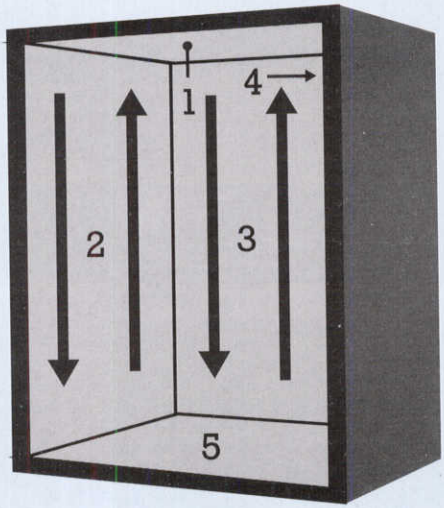
Horizontal Surface

Vertical Surface

Making a Patina

SPRAYING TECHNIQUES

- Carefully plan the sequence of spraying motions in order to varnish the entire object.
- Usually spraying is done in alternating upward and downward motions.
- In some cases, especially for horizontal surfaces, sideward spraying motions are required.
- Planning the sequence of spraying is especially important for varnishing enclosed surfaces.
- It is important to be methodical in order to achieve a finely sprayed surface.



OILING

- You can use boiled linseed oil or china wood oil which is very durable and has a superb finish.
- These finishes are very easy to apply and they are environmentally friendly.
- Oil is however highly flamable and extra care is needed to avoid the risk of fires. Oils should always be stored in cool places and never exposed to heat. Cloths soaked with oil should be safely disposed off.
- Apply oil to the bamboo surface using a cloth, brush, sponge, or handblock. Wipe away the excess, let it dry and apply a second layer.
- The oil penetrates the bamboo without leaving a film on it.
- Fine sanding paper lubricated with oil can be used between the layers to increase the smoothness. Use only sanding materials that can withstand moisture (e.g. sanding paper with a fabric backing, special hand blocks or very smooth scrubbing pads).
- Oil finishes can be repaired and a new layer can always be applied when needed.
- Oiled surfaces can be polished with wax (mixture of beewax and carnauba wax) as the last layer.

STEP 40

- Before varnishing remove all dust from the furniture by using a clean fabric and/or air pressure.
- Attention: dust particles that are not removed will result in a rough finish.

STEP 41

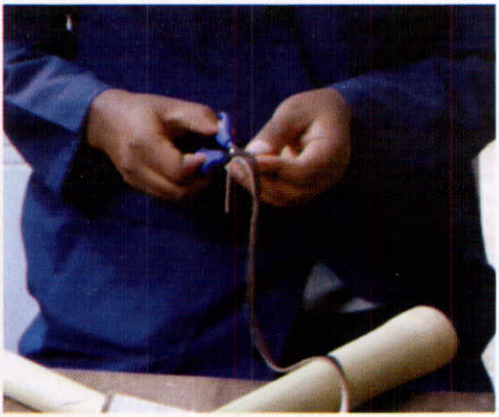
- Place the furniture in an elevated place so that you can easily varnish it from all sides without moving or touching it.
- If varnishing is to be done with an aerosol spray can, shake the can thoroughly for about 1-2 minutes before use.
- Do a spraying test before spraying your product.

STEP 42

- Hold the can approximately 20-30 cm away from the object being sprayed.
- Move it rapidly back and forth making sure that the entire surface is being sprayed equally.
- For flat areas spray in alternate horizontal and vertical strokes
- Spray in light coats to cover the entire surface.
- Several coats may be applied but avoid heavy spraying which can cause the varnish to run.

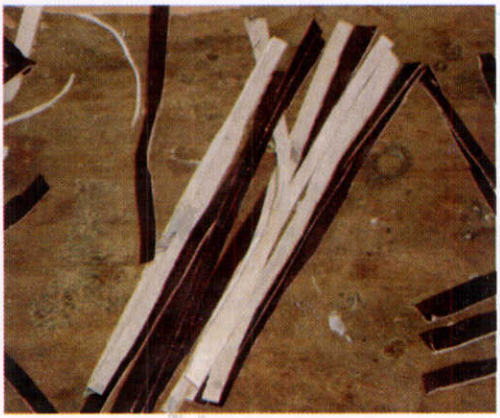
DECORATIVE FINISHING TOUCHES

Additional items (e.g. ropes, leather, beads or glass) may be added after the varnish has dried completely.



STEP 43

- Prepare the leather strips according to the pattern you want to make.
- Additionally prepare four long strips (50cm each) to fasten the woven designs on the top of the four ends.



STEP 44

- Dimensions for the strips needed will depend on the design. For example, 16 strips of 1 cm width and around 20 cm length may be sufficient for making simple decorative covers for the 4 vertical top ends of the shelf.

STEP 45

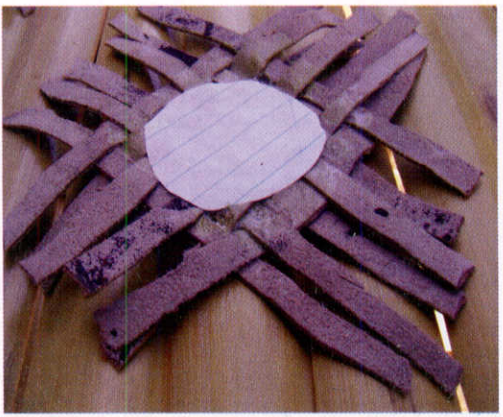
- Use the leather strips to weave the design.
- Always work on a flat surface.

STEP 46

- Apply contact glue to rear side of the woven leather design.
- Keep the visible side of the stripes clean from glue.

STEP 47

- Reinforce the woven leather strips by pasting a round piece of paper or fabric on the contact glue.



STEP 48

- Use contact glue to fix the leather decorations to the bamboo.
- Contact glues needs to dry a bit before applying the pieces.
- After applying the glue wait 5-10 minutes before placing the leather decorations.

STEP 49

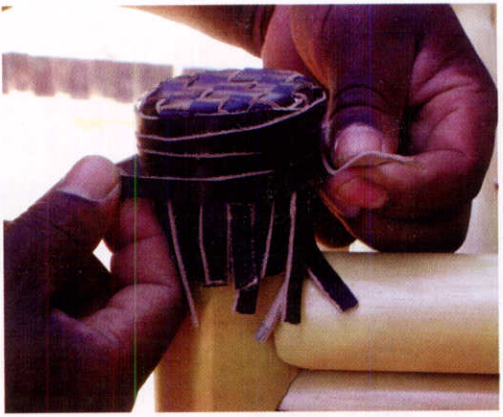
- Position the decoration properly to achieve the best effect.

STEP 50

- Firmly tie the leather strips around the bamboo leg posts.

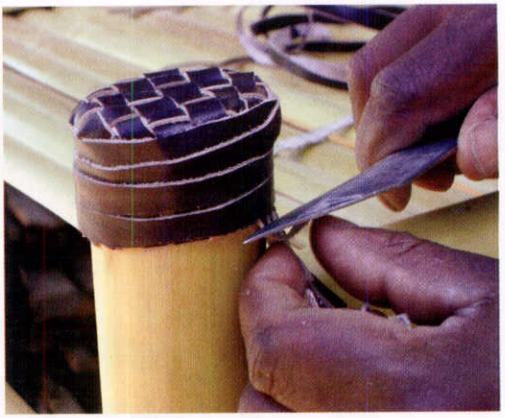
STEP 51

- The leather should be tied as neatly as possible to give an aesthetic look.



STEP 52

- Cut the leather properly without damaging the bamboo surface.




IRWIN