

presents Ron Tomasch on  
**Turning a Mini Hat**

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*Handout written by Chris Ramsey  
and with permission from Chris  
provided by Ron Tomasch for the  
WWCNY Members*

The mini hat can be a bi-product of the full size hat. The wood used for a mini hat comes from either a cored piece from inside the cap section of the full size hat or a tree with a minimum diameter of 10 inches. A mini hat is turned from fresh cut or “green” wood only.

The mini hats sell incredibly well and are a wonderful item to add to your product line. They make wonderful conversation pieces for turners and collectors alike.

Nearly all of the steps used to turn a full size hat are incorporated in the turning of a mini hat. The turning is basically the same but on a smaller scale.

### Design

There are several styles of mini hats including the cowboy, outback, derby, top hat, 10-gallon cowboy hat, sunhat, fishing hat and ball cap. There are variations to all of the styles. This handout features the mini cowboy and outback styles.



### Wood

When using a branch or small tree, select a section that is a minimum of 10 inches in diameter and cut a section of the branch 8 inches long. Cut the section in half in the same direction of the small split in the center of the branch. This will give you two mini hat blanks. Each blank will need to be a minimum of 4 inches tall. You will need to stay away from the pith or center of the tree by about 1½ inches to keep the hat from splitting when placed in the bender and under side to side pressure to make the hat bend. See *Figure 1*.

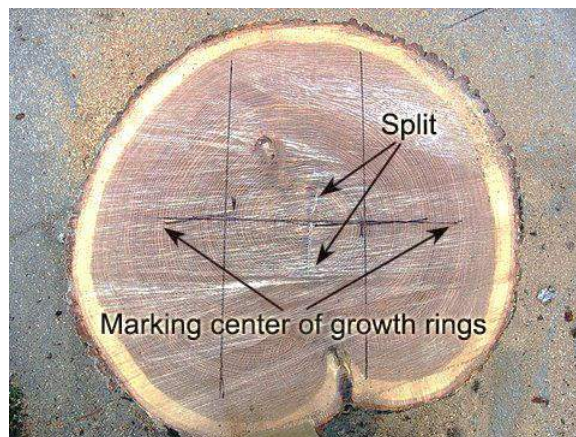


Figure 1

Score a line from pith to pith on the end grain and transfer the line to the flat surface. Put the point of a compass in the middle of the line and draw a circle 8 inches in diameter. See *Figures 2 & 3*.

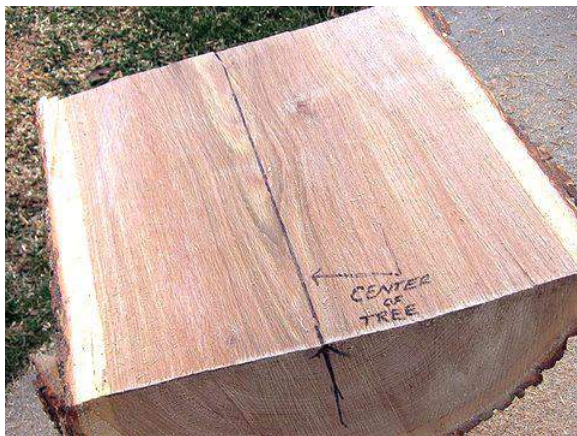


Figure 2

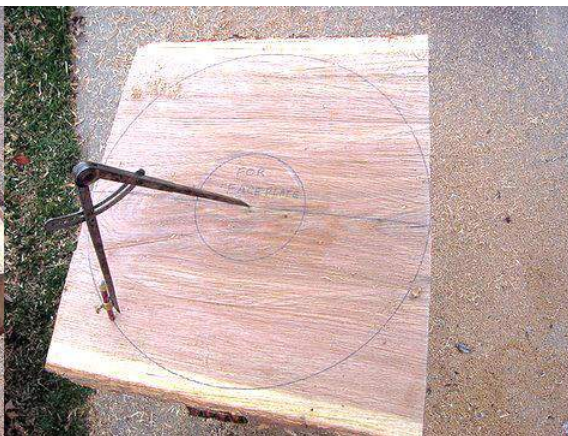


Figure 3

The corners of the blank can be removed on the lathe or with a chainsaw and the blank can be cone shaped prior to mounting on the lathe if preferred. See *Figure 4*



Figure 4

## Tools

$\frac{1}{2}$ " bowl gouge

$\frac{3}{8}$ " bowl gouge

$\frac{1}{4}$ " mini gouge 8" calipers

Moffett light or a Gary Sanders light system or both.

## Step 1 Rough in the Blank

Mount a faceplate on the lathe. Put the flat side of the blank against the faceplate and center the blank using the circle previously drawn as a reference to center the blank. Bring up the tailstock and secure blank in place with pressure between centers. See *Figure 5*.

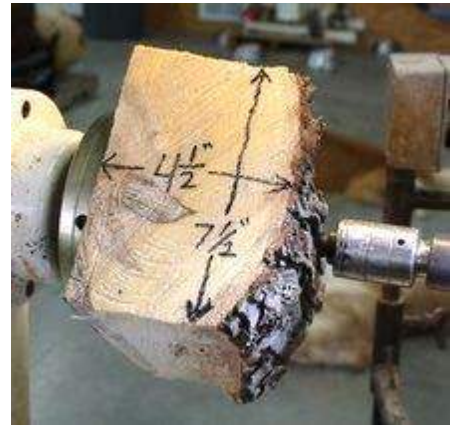


Figure 5

Round the blank and cut a small tenon on the top of the blank so it can be gripped by a chuck. See *Figure 6*.



Figure 6

Remove the faceplate, mount the chuck on the headstock and mount the blank in the chuck using the tenon you have created.

Turn the bottom of the blank flat and cut a  $2\frac{1}{2}$ " mortise in the center so it can be held in the chuck. See *Figure 7*.



Figure 7



Remove the blank, turn it around and re-mount it with the bottom of the blank held by the chuck in the mortise you have created.

**If you are using a previously cored blank you will start here.**

See *Figure 8*.



Figure 8

## Step 2 Turn the Outside Shape

The outside shape of the hat will be turned first. True up the blank on the bottom and side.

The diameter for a mini hat brim is 7" to 7¼ inches.

Turn the blank to a diameter of 7 or 7¼ inches.

Set your outside calipers to 3⅛ inch.

Measure from the bottom of the blank toward the top of the hat ½ to ¾ of an inch and mark with a pencil. This will be the brim and the fall of the brim from the bottom of the cap and hat band to the bottom of the brim.

Remove all material on the cap section of the hat leaving it 3⅛ inch diameter.

Measure from the top of the brim where the brim meets the cap section of the hat up toward the top of the hat 2 inches and make a pencil mark. This will be the height of the cap section of the hat. Be sure to leave ½ to ¾ inch material above the top of the hat so it can be held in a chuck when hollowed.

The hatband will be ⅜ inch tall. Move up ⅜ inch from the top of the brim and make a mark. The hatband will be 1/16 inch thicker than the hat. See *Figures 9 & 10*.



Figure 9



Figure 10

Turn the outside profile shape of the hat stopping at the top of the hatband. This can be straight or have a gentle ogee shape from the top of the hat to the hat band. The top of the hat will have a small curve inward leaving no sharp corners and leaving a tenon above the top of the hat.

Now turn the profile shape of the brim of the hat. For the brim, remove material from the outer edge of the brim to 1 inch inward and flat then from there incorporate a gentle curve upward to the bottom of the hat band. After the outside shape has been established true up the tenon and bring the tailstock up to create a live center mark for alignment after hollowing. See *Figures 11 & 12*.



Figure 11



Figure 12

### Step 3 Hollowing the Hat

Now the hat can be hollowed using light as a gauge and calipers to verify thickness. Remove the hat from the chuck, turn the hat around and place the tenon end in the chuck so it is held by the top of the hat. See *Figure 13*.

**Hollow from the outside toward the inside only** matching the outside shape until a thickness of  $\frac{1}{8}$  inch is achieved.

Hollow the brim first and once the brim thickness is satisfactory, begin hollowing the cap section of the hat. Stay a minimum of  $\frac{1}{8}$  of an inch to the inside of the darker area as the cap is hollowed. Continue hollowing to the top as you follow the outside shape of the hat to  $\frac{1}{8}$  inch thick consistent wall thickness.

The shape of the top of the hat can vary greatly. The top can be flat, dished inward, bulging outward or have a detail like the Stetson “Gambler” style hat.

After turning the detail in the inside top of the hat, the excess “free” water can be blown out with an air hose to expedite the drying so it can be sanded.

Sand the hat (while wet) with 120, 180 and 220 grits sandpaper. The inside of the cap will have to be sanded by hand then the brim can be power-sanded.

After sanding with 220-grit brush on a coat of lacquer and let the lacquer dry.

### Step 4 Turn the Top of Hat Detail & Sand the Hat

Mount the lighted jam chuck in the chuck and make sure it is turning true.

Turn on LED lights and place the hat over the jam chuck and align using existing live center mark. When properly aligned bring up tailstock for support. See *Figure 14*.

Remove excess material turning the top of the hat to  $\frac{1}{8}$  inch thickness leaving a nub in the center of the hat for support from the tailstock. The center of hat becomes flexible and light will begin to shine through as material is removed. See *Figure 15*.

Sand the outside of the hat (with the exception of the top of the hat) with 120, 180 and 220 grits.



Figure 13



Figure 14



Figure 15

## Step 5 Burnishing the Hatband

Place the tool rest up close to the hatband and apply padauk (end grain only) to the band as shown.

Apply ebony (end grain only) to the band to give the padauk a “trimmed” look. This gives the appearance of an attached hatband.

See *Figure 16*.



Figure 16

## Step 6 Sand the Top of the Hat

Turn off the nub in the middle of the top of the hat, remove tailstock and sand the top of the hat with 120, 180 and 220 grits. Apply a brush on coat of lacquer, let lacquer dry.

## Step 7 Bending the Mini Hat

Place the hat in a mini bender. Unlike the full size hats, the mini hats can withstand quite a bit of pressure in the bender. See *Figure 17*.



Figure 17 – Cowboy Hat

The grain must run parallel with the direction of the bend. The front of the hat and the back of the hat must be end grain sides or the hat will not bend properly and will crack. Apply a **fair** amount of pressure by tightening the bender. Put 1 rubber band across the brim on the cowboy hat to aid in the extreme bending of the western style. See *Figure 18*.

For the *Outback* hat, place it in the bender and apply a **fair** amount of pressure. Put brim benders on the front of the brim and apply one rubber band to pull the front of the hat down. Put one rubber band across the brim to bend the sides upward a bit. See *Figures 19 & 20*.



Figure 18



Figure 19

Figure 20

Allow the hat rest in the bender with a fair amount of pressure for the first 10 to 12 hours. After a minimum of 10 hours then the bender can be tightened substantially.

Place a heat lamp with a 75 watt bulb about 6 inches over the top of the hat in the bender. Within a few hours the hat will be bent to shape but will continue to shrink for the next 15 to 20 hours. See *Figure 21*.

### Step 8 Final Hand Sanding & Finishing

After the hat has been in the bender for a minimum of two days it can be removed from the bender and sanded with 220-grit. Sand the inside and the outside with 220-grit but **DO NOT SAND THE HATBAND**. The color from the burnishing can easily be sanded off. The band will have a texture to it created by the burnishing process that makes the band look like a different material.

Apply a finish directly after the hat is removed from the bender and is sanded. If moisture is introduced through humidity, it can cause the hat to slightly lose some of the bend. This is why it is important to get a finish on it after sanding.

I use a catalyzed sanding sealer and apply a minimum of three coats of sealer then apply on coat of catalyzed lacquer to finish the mini hats.



Figure 21



## **Measuring your head**

The following steps will help to ensure your custom wooden hat is a perfect fit.

1. Buy or borrow a curvex (flexible) ruler.



2. Place the curvex ruler around the head at the exact place where the hat will be positioned when worn. Hold the curvex ruler with two fingers at the forehead, wrap the ruler around the head approximately 1/8 to 1/4 inch above the ears.



3. Push the ruler against the head so that there are no spaces between the ruler and the head. (the ruler will overlap at the ends.)



4. While wearing the ruler, pinch the overlapping ends of the curves ruler together so that the size does no change while removing it from your head. Make certain not to change the size or the shape of the conformed ruler when removing it from your head as this will dramatically affect the size and shape of the final product.





5. Place the ruler on a piece of paper making certain not to change the size or shape of the conformed ruler and trace the inside of the ruler's size/shape on a piece of paper to make a pattern of the head. Repeat the steps 2-5 two more times (using the same pieces of paper, overlapping the tracings) to verify that the measurement remains the same each time.





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## **Making a Full Size Hat Jam Chuck**

Start by gluing up several pieces of hardwood or MDF measuring 9" x 9" x  $\frac{3}{4}$ " or 1". Match grain direction for best results if using hard wood. One solid piece of kiln dried hardwood is also acceptable.

The dimensions when glued up or solid block need to be 9" wide x 9" wide x 6" tall. The pieces can be cut into discs on a band saw into 9  $\frac{1}{2}$ " dimensions before gluing to save a little time when chucked on to the lathe.

After glue has cured, locate center of blank by marking from corner to corner forming an X on each end of blank. Using a faceplate on the headstock, bring up tailstock in the center of the X on the tail stock end which will center the blank. Use extreme pressure to jam chuck the piece against the faceplate. The 9" x 9" surface against the faceplate will provide a perfectly flat surface that is safe to turn when the tailstock is applied with great pressure. This will give you a flat plain to begin roughing the blank. If you are not comfortable with jam chucking against the faceplate, this can be turned between centers. Round the blank and turn a mortise on the tailstock side that can be held by a stronghold chuck. Remove from lathe, remove faceplate and install stronghold chuck. Mount the blank on the stronghold chuck gripping the blank in the mortise. Bring up the tailstock for safety and support.

Next, perfectly flatten the tailstock side and turn a mortise on the tailstock side that will be used by the stronghold chuck to hold the blank as pictured.



After turning the mortise, put the blank back on the lathe using the stronghold chuck in the mortise.

Round the blank and flatten the tailstock side.

The jam chucks finished diameter will be evenly tapered from **8 1/2" OD** (outside diameter) at the **headstock side** to **6 3/4"** at the **tailstock side**. I used a straight edge ruler to make sure that my taper was even from 8 1/2" at the headstock side to 6 3/4" at the tailstock side.

Hollow the jam chuck to a 1" wall thickness leaving the jam chuck 1 1/2" thick on the bottom side. Flatten the hollowed bottom inside of the jam chuck.

Sand the outside of the jam chuck to 220.

Use 1/4" thick neoprene (wetsuit material) that will be applied to the outside of the jam chuck. The neoprene should have one side that is rubber and the other side is material. Neoprene can be purchased from material suppliers or dive/surf shops. I found an over-sized place mat at Hobby Lobby that was made of neoprene and cost \$5.20 and used it. You can transfer the width, size and shape of the jam chuck onto the neoprene and get a correct size and radius by placing the jam chuck on its side on a large piece of neoprene and mark the side widths of the jam chuck onto the neoprene as you slowly roll the jam chuck 360 degrees. Your drawing on the neoprene will need to be three inches longer on the end than necessary to get a good fit when glued onto the jam chuck. The drawing on the neoprene will be shaped in a radius (like the shape of a rainbow as pictured).



Using the cut neoprene there will be a few extra inches of extra neoprene that will overlap when put on the jam chuck. **Do not remove the extra material at this point.**

**This can be cut to a perfect fit by the following steps:**

Before applying spray adhesive, dry fit the neoprene to the jam chuck. The neoprene should start flush with the hollowed out end of the jam chuck. Tape the leading end to the jam chuck and rotate the chuck while wrapping the neoprene.

If and when you are satisfied with the fit use a pencil to make a mark on the jam chuck on the starting edge. This will give you an exact reference point with perfect alignment to begin applying the neoprene when sprayed with adhesive and ready to install.



Mount the jam chuck on the Stronghold chuck and apply the spray adhesive per the instructions on the spray adhesive can. To get an even coat of spray adhesive, turn on the lathe at the slowest speed and apply the spray adhesive. (Cover the lathe bed with an old towel or sheet to minimize the mess.)

Place the neoprene on a newspaper and apply spray adhesive to the rubber side **ONLY** of the neoprene.

Allow the adhesive to become “tacky” on both the jam chuck and the neoprene. This usually takes about 5 minutes.

With the leading edge of neoprene, line up the edge with the pencil mark you made on the chuck and apply the neoprene starting edge. Rotate chuck slowly by hand while applying the neoprene. **Keep neoprene even and tight so there will be no wrinkles when applied to the chuck.**

After rotating the chuck 360 degrees you will have 3 or 4 inches of extra neoprene on the end. Overlap the neoprene evenly and get a very sharp razor blade. With the neoprene overlapped evenly, use a straight edge to get a straight cut with the razor blade on the overlapped neoprene ends. Make sure to cut all the way through both layers of neoprene in one cutting motion. This will give you an exact matched cut for the two ends of neoprene to be butted together.

Next you will remove the extra neoprene that you have cut with the razor blade and butt the ends together for a perfect fit as pictured.



Purchase a solid metal electrical outlet cover at Lowe’s or any electrical supply store. Screw and glue the metal cover in the center of the inside bottom of the jam chuck as pictured.



Purchase a 3 3/4" diameter LED battery powered puck light that has a magnetic base (pictured). My light is made by Ullman and is a model RT-48LT. I bought mine online. Install the LED puck light onto the metal plate inside the jam chuck as pictured. The magnetic base will hold well if centered properly as pictured.



Now your jam chuck is complete and ready to use.





## How to Make a Hat Bending Jig

### MATERIALS

One 2" x 8" x 11" long (Base Block) exact measurements are 7 1/2" x 1 1/2" x 11" (Pine is OK to use, I have used scrap Walnut for my benders)

Four pieces of Oak 1" x 2" x 32" (Oak Staves) exact measurements are 3/4" x 1 1/2" x 32"

One piece of all thread 3/8" x 13" long

One 3/8" washer

One 3/8" wing nut

One piece of any hardwood (I use Walnut) 2"x 6"x 2 feet. Out of this piece of wood you will cut two pieces of the all thread blocks and two pieces of the cap cups from the patterns included on the templates page. Templates for these items are below. See photo #11

When all parts have been acquired and all pattern cuts have been made, assembly of the bender takes just a few minutes.

### ASSEMBLY

Lay out the markings for the staves on the base block by measuring the 11" inch block from left to right. Make a mark at 3 3/4" and 7" on each of the two long sides of the base block as pictured in photo #1.

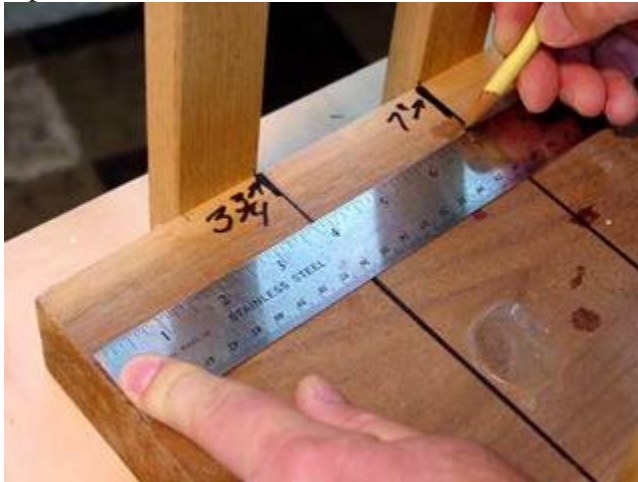


Photo #1

Pre-drill oak staves on bottom and fasten to base block as pictured. (#2)



Photo #2

Pre-drill 1/16" hole on the outside edge of each stave 18" from the bottom as pictured (#3) and install one 1" drywall screw. The screws are for the rubber bands to hook to as bending and shaping occur.



Photo#3

Pre-drill and countersink the center of the outside edge of the staves  $\frac{3}{4}$ " down from the top of the staves. Drill all the way through the staves with a 1/16" drill bit. Countersink the holes  $\frac{1}{2}$ " and attach the cap cup block as pictured in #4



Photo #4

Make sure to leave a 1/8" gap between the stave and the cap cup block so that the block can pivot up and down and will conform to the angle of the hat to be bent. (#5)

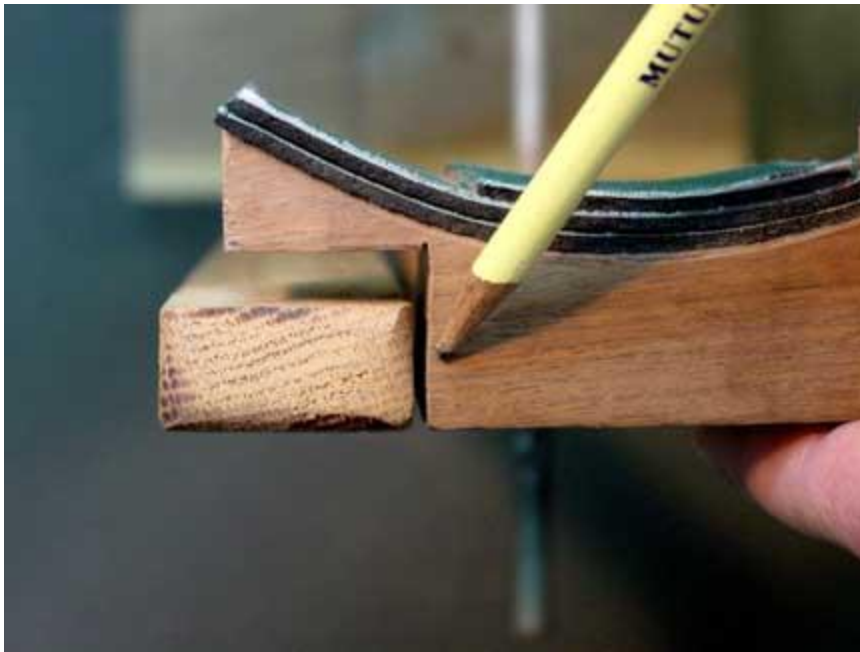


Photo #5

Install all thread through all thread blocks and install on bender as pictured. (#6)





Photo #6

I have included a template page for two kinds of brim wrenches, the Cowboy/Outback and the Top Hat brim wrenches. The wrenches should be made of  $\frac{3}{4}$ " stock with the corners and sides sanded smooth. Included are pictures of the brim wrenches in use. (#7)



Photo #7

Also included is a picture of a template made from the head measurement. This insures that the hat will fit perfectly IF the measurement was done correctly. Use the drawing of the measurement to make a template. Cut out the paper template and transfer it to a piece of stock that is  $\frac{3}{4}$ " thick. Cut out the template on a bandsaw then sand the edges so that they are smooth. The head measurement template is used when the hat reaches the final width needed for the person's head. It is installed as pictured in the hat. Remember to place it in the hat upside down because the hat in the bender is upside down. See photo #8



Photo #8

A hat width block can also be used and installed when the hat is in the bender and has bent to the side to side head measurement as pictured in photo #9.



Photo #9

I have included templates for a hat width block and brim wrenches for the outback hat and curved brim wrenches for the derby and top hat pencil-rolled brims. See photo #10

# Hat Width Block

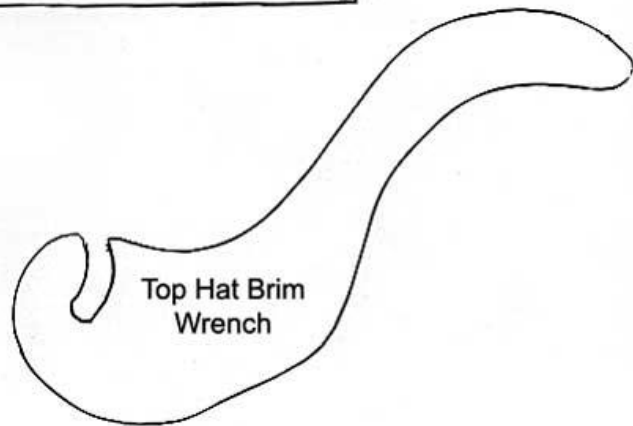
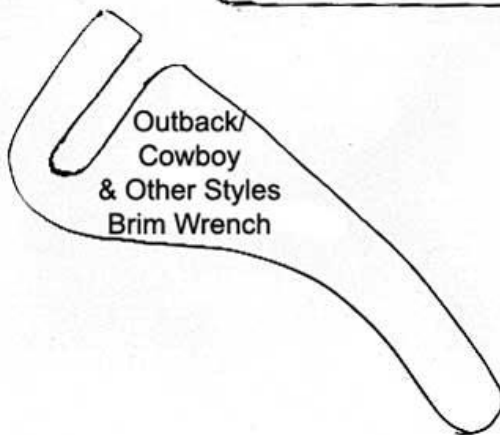
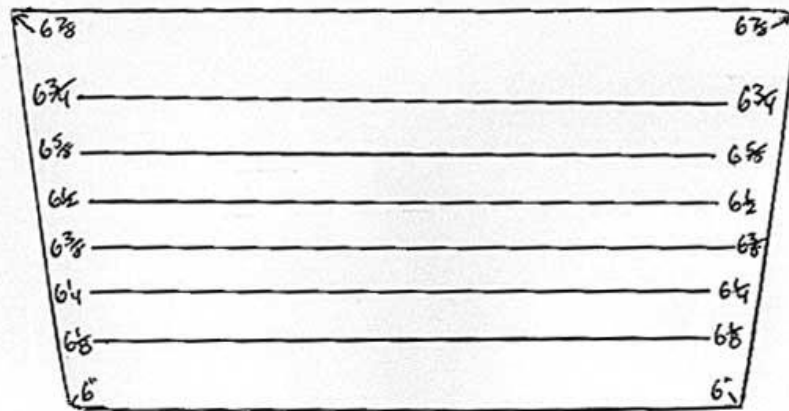


Photo #10



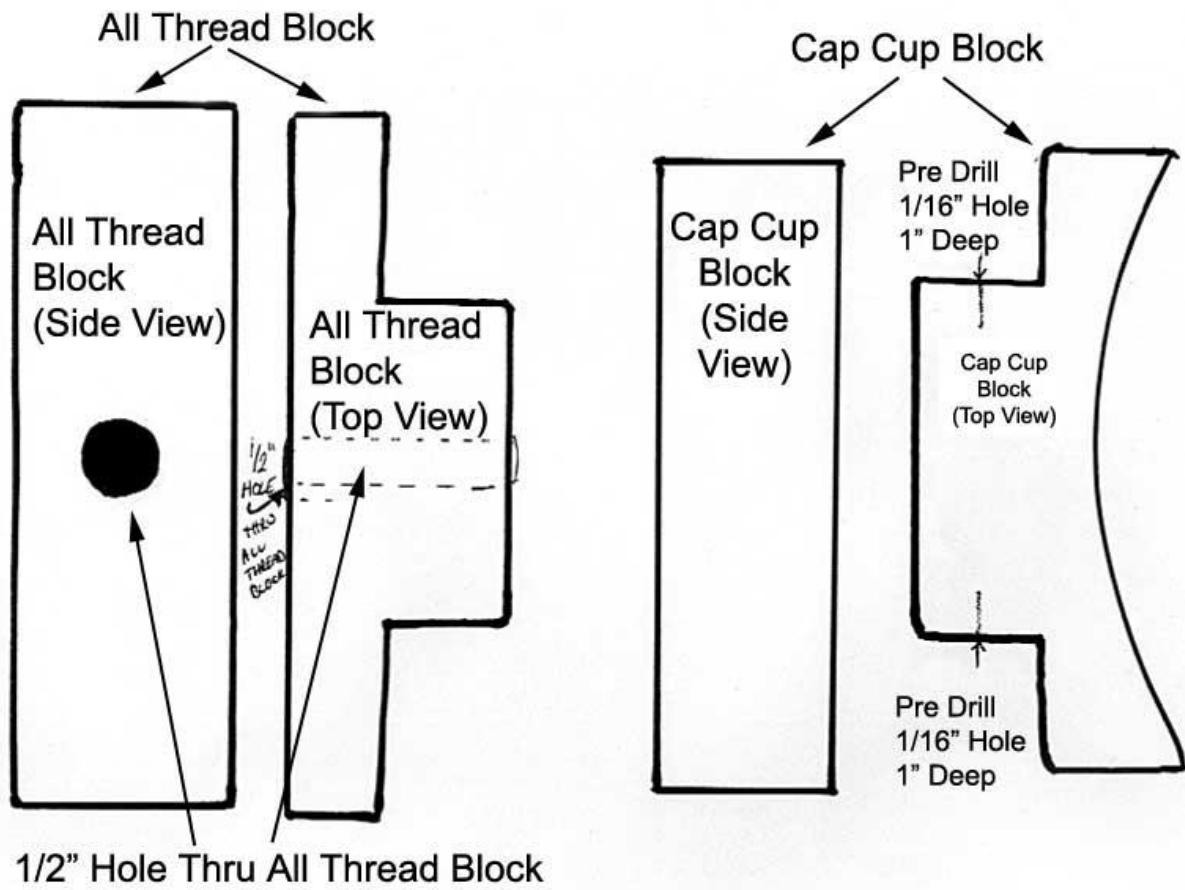


Photo #11

# **The Turned Wood Hat**

## **Introduction**

The lathe turned wood hat is first mentioned in literature as having been fabricated by William Murdock in 1777 (see “The Lunar Men”) and is a wonderful project because of the numerous possibilities (kinds, shapes and sizes) that can be turned. Hat turning will increase your comfort level regarding thin-wall turning and assist you in learning about bending green wood as it dries.

## **Design**

The two types of hats covered in this literature are the Cowboy Hat and the Outback Hat which rank highest in popularity and are the easiest to turn.



Cowboy



Outback

## **Wood**

It is important to use a light colored wood when you are learning to turn hats. I recommend starting out with fresh cut or “green” maple. The water content in maple is plentiful and the light color will aid in using a light bulb to gauge the wall thickness as the hat becomes thinner with a final goal of 3/32”. When learning, I suggest that you avoid walnut since the dark color does not allow much light to shine through.

To *burnish* on the hatband you will need a piece of ebony (or black wood) and a piece of padauk (or rosewood.) I use ebony and padauk for all of my hatbands. The wood will need to be cut to 1/8” thick. I use a piece 3/4” thick by 8” or so long and sharpened to a point.

## **Tools**

1/2” bowl gouge

3/8” bowl gouge

1/4” mini gouge

8” calipers

18” calipers

Moffet light or a Gary Sanders light system or both.

3 inch sandpaper disks with 120, 180 and 220 grits

Power sander

120, 180 and 220 grit sheet sandpaper

## **Measuring Your Head**

### **Step 1 - Determine the hat size**

- Secure a flexible curve ruler.



- Place the ruler around the head at the exact place where the hat will be positioned when worn. Hold the ruler with 2 fingers at the forehead and wrap the ruler around the head approximately  $\frac{1}{8}$ " to  $\frac{1}{4}$ " above the ears.



- Push the ruler against the head so that there are no spaces between the ruler and the head. (The ruler will overlap at the ends.)



- While 'wearing' the ruler, pinch the overlapping ends of the ruler together so that the size does not change while removing it from your head. Make certain not to change the size or the shape of the conformed ruler when removing it from your head as this will dramatically affect the size and shape of the final product. The ruler needs to be snug and comfortable but not too tight.



- Place the ruler on a piece of paper making certain not to change the size or shape of the conformed ruler and trace the **INSIDE** of the ruler's size/shape on a piece of paper so you will have the size and shape of the head.



- Repeat the steps 2-5 two more times (using the same pieces of paper, overlapping the tracings) to verify that the measurement remains the same each time.

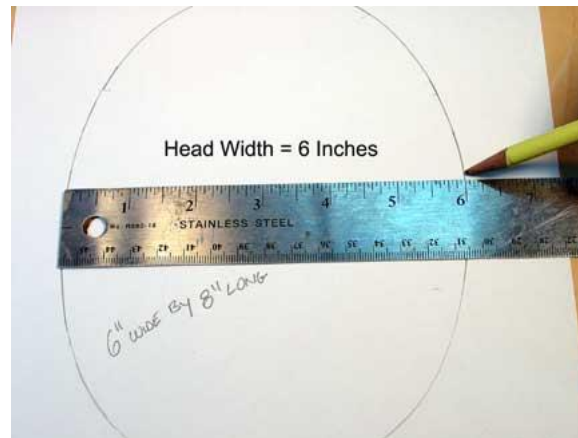
### **Sizing the Hat**

After wrapping the ruler around the head and tracing the shape of the head on a piece of paper, the following instructions are a sure way to calculate the OD (outside diameter) needed for hat sizing.

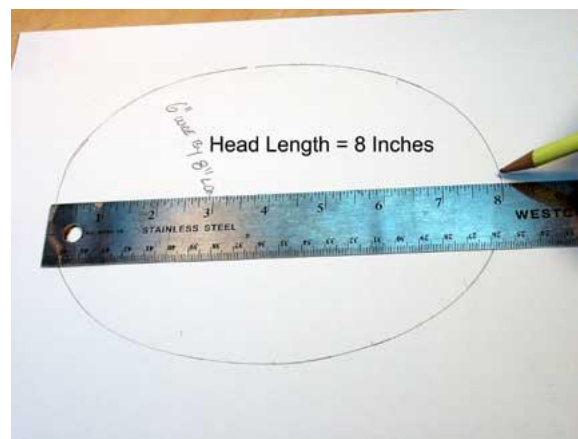
- Using a ruler, measure the widest point of the head from side to side and record the measurement. In our model's case the measurement was 6".
- Measure the greatest length from the front to the back of the head and record the measurement. In our model's case the measurement was 8".
- Determine the distance half way between the width (6") and the length (8") In our model's case this was 7".
- Add  $\frac{1}{2}$ " for OD measurement. In our model's case the OD to turn was  $7\frac{1}{2}$ ". The formula for arriving at the  $\frac{1}{2}$ " is as follows:  $\frac{1}{4}$ " (for wall thickness of  $\frac{1}{8}$ " plus  $\frac{1}{8}$ ") and  $\frac{1}{4}$ " for total shrinkage of the blank.

The following pictures illustrate how to get the OD round measurement of a person's head.

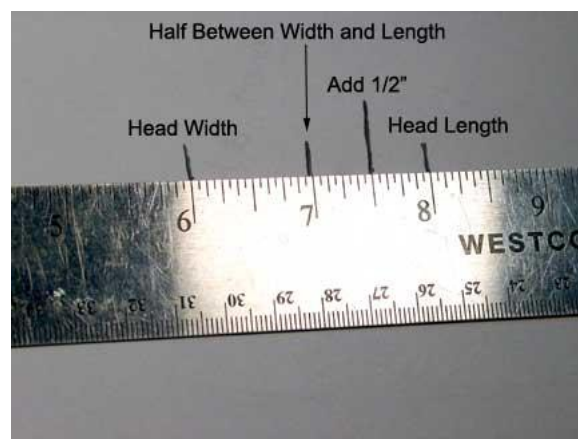




Head Width



Head Length



Determining the Outside Diameter

We will assume the hat size is  $7\frac{1}{2}$ ".

## Step 2 - Prepare the blank

Select a fresh piece of timber. The tree will need to be a minimum of 18" in diameter for a cowboy hat.

Use a chainsaw and cut an 18" long piece of the log.

Look at the center of the log and notice the direction of the split. Stay a minimum of 1½" to the outside of the center or pith of the tree and, using a straight edge, draw a line from bark edge to bark edge following the direction of the split. (Do the same thing on the other side of the split and you will have two hat blanks.) If you cut to close to the pith the hat will crack during the bending and drying process.

Mark the center of the tree's growth rings on both ends so the growth rings can be easily lined up when the log is cut in half. See Fig. #1. This will make the hat appear very well balanced.

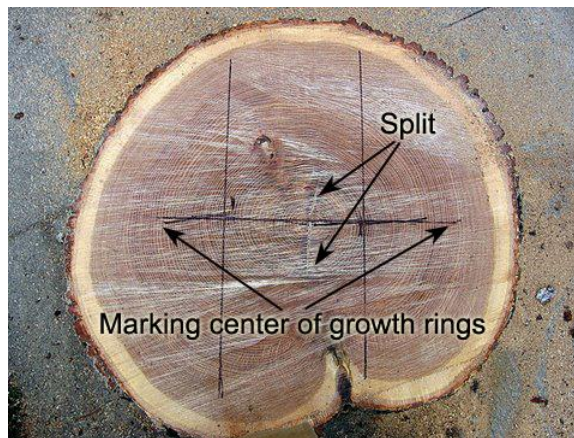


Figure 1

Cut the 18" section of the log in half following the mark you made from bark to bark edge. See Fig. #2.



Figure 2

Transfer the mark from the pith of the tree on the end grain ends to the side grain ends. Draw a line connecting the two marks. See Fig. #3.



Figure 3

Using a compass put the point of the compass in the center of the line and draw a circle with the diameter of 18" (which will be the brim) and another circle with a diameter of 6". See Fig. #4. (The 6" diameter will be used to line up the blank on a 6" faceplate.)



Figure 4

Stand the piece up and cut a flat spot the length of the blank parallel with the brim. The blank must be a minimum of 7 ½" thick (preferably 8" thick) for these style hats. See Fig. #5



Figure 5



Place blank on the flat spot and cut the corners and excess material outside the brim circle. See Fig. #6.



Figure 6

Place blank with brim down and cut into a cone shape. This will greatly reduce turning time and make it much easier to turn. Be sure to leave about a 10" uncut circle on the top of the blank. See Fig. #7.



Figure 7

Step 3 - Rough in the blank

Using a 6" faceplate, mount the blank on the lathe with the brim side facing the headstock. Line up the 6" circle previously made with the 6" faceplate. See figure 8.



Figure 8

The blank is held in place with a great deal of pressure. If you are uncomfortable using pressure to hold the blank you can use screws in the faceplate. (If you use screws you will have screw holes in the brim of the mini hat that will be cored from the inside of the hat.) Next you will turn the top of the blank flat to accept the 6" faceplate. See figure 9. Leave the top surface about 6" wide to make the alignment of the faceplate easier. Remove the blank from the lathe, remove the nub and secure the faceplate with screws. Use a center point finder to mark the inside center of the faceplate. See figure 10.



Figure 9



Figure 10

Mount the faceplate/blank back on the lathe. The blank may be a little out of round so it now needs to be "trued up."

#### Step 4 - Determine the size of the brim

The **cowboy hat** has a 4" brim. To determine the brim diameter we will add 8" (This is for a 4" brim on **both** sides) to the previously determined 7 1/2" for the head size. Our brim diameter will be 15 1/2". The brim size can be changed to your own preferences.



For An **outback hat** has a three inch brim so we will add 6" to the previously established OD head measurement. (This is for a three-inch brim on **both** sides) Our outback hat will have a brim diameter of 13 1/2". The brim size can be changed to your own preferences. Transfer the brim measurement to the brim on the blank and turn away the excess material.

Turn the bottom of the brim flat and make a mortise (recessed area) in the center of the blank to accept the Stronghold chuck when the hat is reversed. See figure 11.



Figure 11

A cowboy hat has a 1/4" bevel on the outer edge of the brim. For a cowboy hat, turn the 1/4" bevel. The bevel should start about 3/4" in from the edge and gently roll up 1/4" to the outside edge.

The outback hat should be left flat at the edge of the brim.

The thickness of the cowboy hat brim to the bottom of the cap part of the hat should be left at 1 1/2" thick at this time. This measurement is the fall from the bottom of the cap to the bottom of the brim.

The thickness of the outback hat's brim to the bottom of the cap section of the hat should be left at 1 1/4" thick at this time. This measurement is the fall from the bottom of the cap to the bottom of the brim. The cap section is 4". See figure 12.



Figure 12

### Step 5 - Turning the outside shape of the hat

The outside shape of the hat is turned first. Remove the blank from the headstock and mount the Stronghold chuck on the headstock. Install the small cone on the tailstock. Mount the mortise on the jaws of the chuck and bring up the tailstock. The small cone will zero into the faceplate's threaded hole. This will perfectly align the blank to run true. Rotate the blank to check for any wobble then tighten jaws of chuck, tighten tailstock.

Set your large calipers on 7 1/2”.

For a cowboy hat the total height from the bottom of the brim to the top of the hat is 6”.

Using your calipers, remove the material on the bottom of the cap where the cap meets the brim until it is 7 1/2” OD at the bottom of the cap. This measurement should continue up 1” up the cap from the brim.

For the hat band measure from the bottom of the cap up 3/4” toward the top of the hat and make a mark with a pencil. Remove the material above the 3/4” mark to until the OD is 1/16” less giving an appearance of a hat band. See figure 13 and 14.



Figure 13



Figure 14

The diameter of the top of the hat can be from 5” to 6” in diameter on average. This measurement may be adjusted for people with smaller diameter hat sizes.

The top corner of the hat should be rounded inward leaving no sharp corners.

Taper the top of the hat to the bottom of the cap section of the hat to just above the hatband. This taper can be straight or a gentle curve depending on your preference.

#### **Step 6 - Shaping the top side of the brim**

For an outback hat, turn the first 1” straight inward then make a gentle curve up to the bottom of the hatband. See figure 13.

For a cowboy hat, the brim was left 1 1/2” thick. Start on the edge of the brim and remove material to match the bottom profile bevel to a thickness of “1/8. Once the bevel has been matched on the top of the brim surface, work your way inward to the area where the cap meets the brim. The shape needed is a gentle, flowing curve. This is important. If it is left straight it will not bend correctly. Creating a shape of a gentle curve gives that hat an area in which it will bend without cracking.

#### **Step 7 - Hollowing the hat**

Remove blank form chuck, remove chuck, remove cone on tailstock. Mount blank back on lathe with attached faceplate.

Now the hat can be hollowed using light as a gauge and calipers to verify thickness.

For a cowboy hat, the hollowing will start inside the beveled edge on the brim. Hollow in 1" increments until you are comfortable with the process. **Hollow from the outside toward the inside only** matching the outside shape until a thickness of  $\frac{1}{8}$ " is achieved.

Once the brim thickness is satisfactory, the mini hat can be cored from the middle of the cap part of the hat. I use the McNaughton straight knife to core the mini hat blank. Plunge inward at a 55 degree angle about  $\frac{1}{4}$ " to the inside of the cap part of the hat. Continue the plunge until the top of the mini blank is small enough to break free and be removed from the hat. Set mini hat blank aside. See figure 15 and 16.



Figure 15



Figure 16

Begin hollowing the cap section of the hat. For the outback hat the outside shape should match the inside and be hollowed to  $\frac{1}{8}$ " wall thickness.

The light will show where the cap section of the hat begins. Stay a minimum of  $\frac{1}{8}$ " to the inside of the darker area (the cap that has not been hollowed.) Continue hollowing in 1" increments to the top as you follow the outside shape of the hat to  $\frac{1}{8}$ " thick. See figure 17



Figure 17

### **Step 8 - Turning the inside top detail of the hat**

The shape of the top of the hat can vary from several different shapes. I fashion the tops of my hats after the Stetson "Gambler" style hat. The outside top of the hat has a  $\frac{1}{4}$ " to  $\frac{1}{2}$ " wide ring then gently rolls down  $\frac{3}{4}$ " to another gentle curve then a subtle rise to the middle top of the hat.

To create this “groove” in the inside top of the hat the 1/4” bowl gouge must be held with the flute facing 3:00. The cut is made from the outer wall of the hat to the bottom of the groove then finish the cut as it rises toward the top middle of the hat.

The center of the detail should be even or slightly lower than the outer ring on the top of the hat. See figure 18.



Figure 18

#### **Step 9 - Sanding the inside of the hat**

Blow the excess “free water” out of the hat with air. I use 150 PSI to expedite the process. (The “free” and “born” water will be discussed in step 14.)

I always sand with the lathe running in reverse. Sand the hat beginning with 120, 180 then 220 grits. The top detail’s inside corner has to be sanded by hand. After sanding is complete, a coat of 50/50% automotive lacquer and thinner is brushed on and let dry. The lacquer slows the drying and aids in the bending process and seals the hat so dirty fingerprints will not corrode the surface. See figure 19 and 20.



Figure 19



Figure 20

#### **Step 10 - Turning the outside top of hat detail and sanding the outside of the hat**

Remove the hat from the lathe; remove the faceplate from the hat.

Mount the lighted jam chuck on the head stock. Turn on LED puck lights. See figure 21 and figure 22.





Figure 21



Figure 22

Place the hat over the jam chuck and align using the previously marked center point. Bring tailstock to center and use little pressure to support the hat. See figure 23.



Figure 23



Figure 24

Remove excess material leaving the top center of the hat with a nub in the center of the top of the hat for the tailstock support. See figure 24.

Sand the outside of the hat (with the exception of the top of the hat) with 120, 180 and 220 grits.

### Step 11 - Burnishing the hatband

Place the tool rest up close to the hatband. Sand the Padauk and ebony to a fine point.

Apply padauk (end grain only) to the band.

Apply ebony (end grain only) to the band to give the padauk a “highlighted” look. This gives the appearance of an attached hatband. See figure 25 and figure 26.



Figure 25



Figure 26



### **Step 12 - Sanding the top of the hat**

Turn off the nub in the middle of the top of the hat. The hat will stay on the jam chuck. Take light cuts so that the hat is not knocked off of center. Remove tailstock and sand the top of the hat with 120, 180 and 220 grits. Apply a brush on coat of lacquer mixed 50%-50% with thinner, let dry. See figure 27.



Figure 27

### **Step 13 - Placing the hat in a bender**

Place the hat upside down in a bender. The grain must run parallel with the direction of the bend. The front of the hat and the back of the hat must be end grain sides or the hat will not bend properly and will crack. See figure 28.

The brim should not be touching the cupped blocks that hold the hat but should be in the middle of the hat band. Leaving the brim touching the cupped block will, 9 times out of 10, crack the hat during the drying process. See figure 29.



Figure 28



Figure 29

Place brim bender wrenches on the front brim of the outback hat. Apply two rubber bands (one around the middle three and one around all six wrenches) the from brim wrenches around the hat securing the rubber bands to the front of the hat. This will keep the hat from being pulled out of the bender as it bends and dries. Place rubber band across sides of hat to bend sides upward. See figures 30 and 31.



Figure 30



Figure 31

Apply a **small amount** of pressure by tightening the benders wing nut.

For a cowboy hat put two sets of three 8 ½" by ¼" red rubber bands strung together across the brim on the cowboy hat from side to side to aid in the extreme bending of the western style. Put three small 2 ½" rubber bands across the front of the cowboy hat brim to help make the front of the hat brim smaller.

If one side bends more than the other side you may adjust the tension by moving the rubber bands to the left or to the right.

**Step 14 - This is extremely important:**

**DO NOTHING TO THE HAT FOR A MINIMUM OF 10 HOURS.**

Most people think, "It's not bending and it's been 2 hours. I had better tighten it up. It's been 4 hours and it's not bending. I better tighten it up again. It's been 6 hours and still no bend. I'll really tighten it up again. Better tighten it up some more.....it's been 8 hours....." **CRACK!!!!!!!!** Don't think like most people. Let the hat rest in the bender with just a fair amount of pressure for the first 10 to 15 hours. After a minimum of 10 hours then the bender can be tightened quite a bit more.

Place a heat lamp with a 100 watt bulb about 8" over the top of the hat in the bender and another heat lamp under the front of the hat in the bender. See figure 32.



Figure 32

The hat will begin to bend to shape and will continue to shrink for the next 15 to 20 hours. Monitor the bending. It is important to monitor the hat after you have applied the heat lamps. Measure the width and apply a hat width block when the desired width is achieved. Remember, our head measurement was 6" wide. Don't let your hat's side-to-side measurement get to be less than the head width of the person that the hat is intended to fit. See figure 33 and figure 34.



Figure 33



Figure 34

The front to back measurement will fall into place on its own. The heat lamps should remain on the hat for a minimum of 12 hours. The heat "sets" the bend in the wood and causes the "born water" to evaporate. The "free water" is what you saw coming out of the blank as it was turned and the excess of the "free water" was blown out of the hat with an air hose. "Born water" is the microscopic drop of water in each wood cell that can not be spun or blown out of a piece of wood. It must evaporate. The bend occurs when the "born water" evaporates. With controlled pressure and heat from the lamps helping to expedite the evaporation the bend can be controlled.

If the head of the individual you measured is not symmetrical then a template of the head measurement must be made. I use 3/4" x 10" stock for the template. For the template cut out the drawing of the head measurement. Place the cut out of the drawing on your stock and trace around the drawing. Cut the traced drawing on a band saw. Use a forstner drill bit to drill two holes in the template to make removal of the template possible. Install the template when the sides are at the template width. See figure 35.



Figure 35

### Step 15 - Final hand sanding and finishing

After the hat has been in the bender for a minimum of two days it can be removed from the bender and sanded with 220 grit. Sand the inside and the outside with 220 but **DO NOT SAND THE HATBAND**. The color from the burnishing can easily be sanded off. The band will have a texture created by the burnishing process that makes the band look like a different material.

Apply a finish directly after the hat has been removed from the bender and has been sanded. If moisture is introduced from humidity, it can cause the hat to slightly lose some of the bend over a period of time. This is why it is important to get a finish on it after sanding.

When properly turned, bent, sanded and finished your hat is a wearable piece of art that will certainly turn heads in any crowd.



### Materials

The Rubber bands can be purchased from:

Manufacturer: Alliance Advantage Rubber Bands SIZE: 8½ x ¼ RED Part #97725

The small and large calipers can be purchased from:

KBC Tools & Machinery

1-800-521-1740 Phone, 1-800-322-4292 Fax

Manufacturer: Starrett

8" small outside calipers: Starrett part #79B-8 Part #1-855-50369 \$24.05

18" large outside calipers: Starrett part #1-812-318 Pricing has increased to \$22.00

The Curvex Ruler used to measure the head can be purchased from: [alpineimport.com](http://alpineimport.com)

1-800-654-6114

Item #TC-383 Flexible Curve 30" \$10.50 each

I use a catalyzed lacquer and a catalyzed sanding sealer to finish the hats. I mix the sealer 50% and thinner 50% and spray on three to four coats allowing each coat to dry. I spray on a final coat of catalyzed lacquer mixed 70% lacquer and 30% lacquer thinner.