

Cluster #12A — Large Wood Turning Lathe

The primary use of the Powermatic, model 3520B wood lathe is to create round shapes. Turning differs from most other forms of woodworking in that the wood is moving while a (relatively) stationary tool is used to cut and shape it.

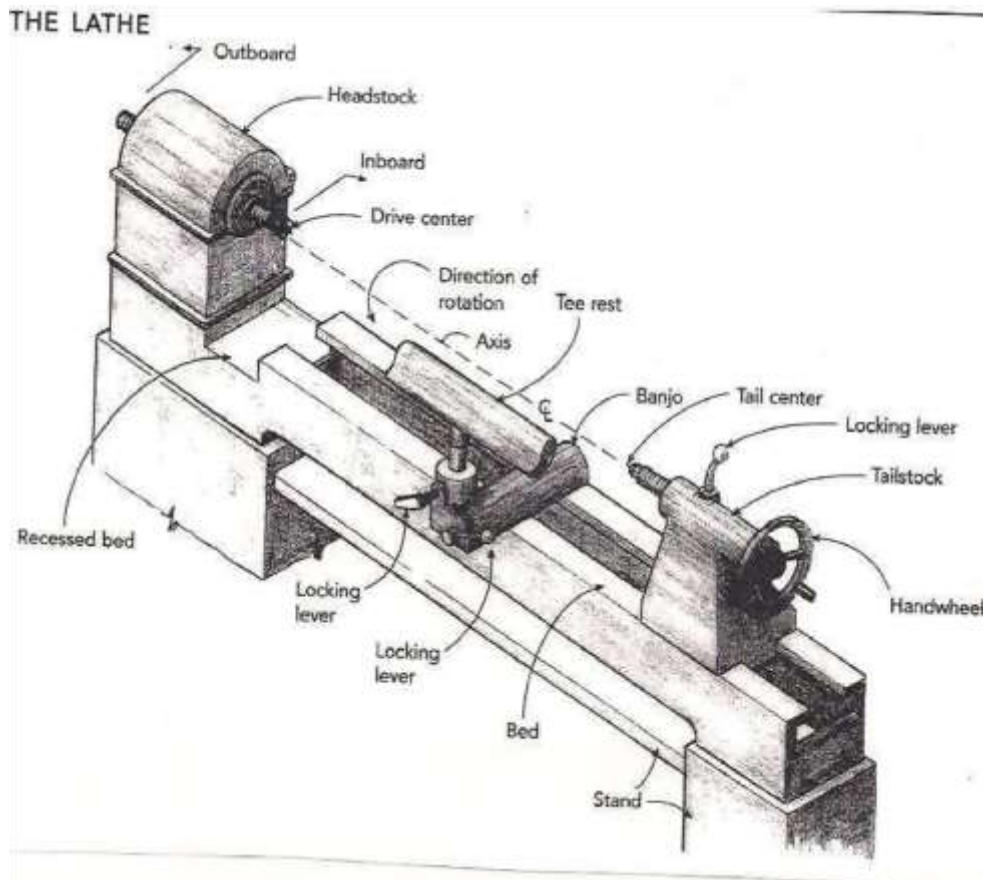
Two types of woodturning are:

- * Spindle turning or turning between centers on a center axis where the wood is turned between the head stock and the tail stock. Spindle turning is the method used to make items such as table legs, lamps, and candle holders.
- * Faceplate turning is when the wood is attached to a faceplate or chuck. The wood runs perpendicular to the axis of rotation. This method is used to make items like bowls and platters.

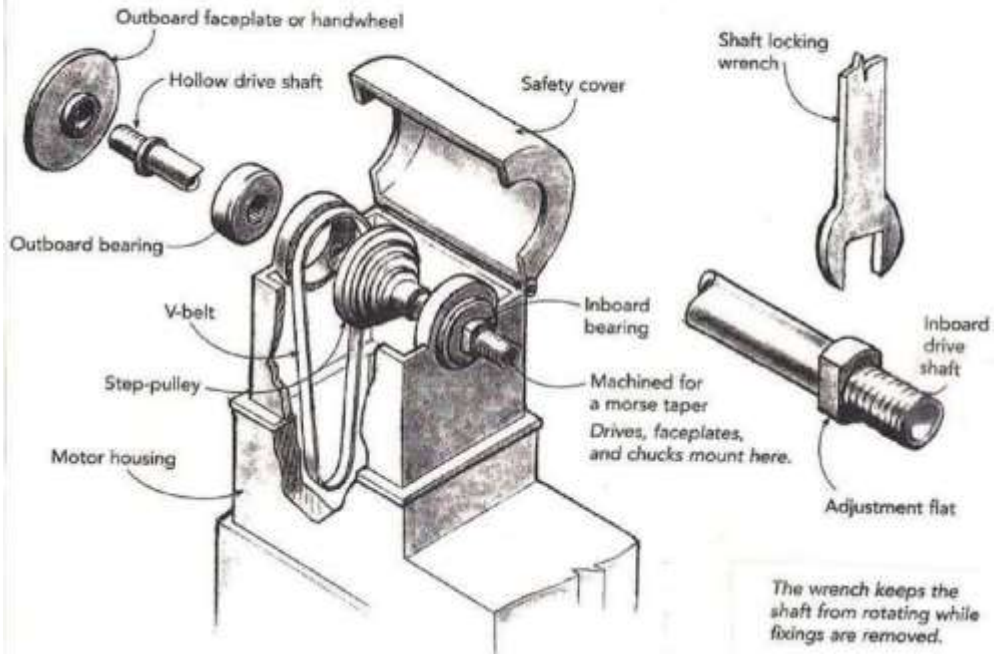
The parts of the lathe are:

- *Head stock assembly:* The head stock assembly is mounted on the lathe bed and houses the motor that drives the work piece and allows the speed to be varied.
- *Tail stock assembly:* The tail stock assembly is located at the other end of the lathe bed. It supports the opposite end of the work piece. A live ball bearing center or dead center can be used to receive the end of the wood. A drill chuck can also be inserted to drill or bore if needed using the Jacobs chuck.
- *Tool rest assembly:* The tool rest assembly is mounted on the lathe bed and is moved into the best position to support the tool for safe operation.
- *Spur center:* The spur center is inserted into the head stock spindle for spindle turning.
- *Live center/Dead center:* The live center or cup center which can be alive or dead is inserted into the tail stock spindle to support the opposite end of the wood to be turned.
- *Face plate or chuck:* The face plate or chuck is mounted onto the head stock spindle so that bowls and other large shapes can be held firmly while being turned.
- *Calipers:* Calipers are used to measure outside and inside diameters of turned work.
- *Dividers:* Dividers are used to step off measurements and to make circles on faceplate work.
- *Turning tool sharpening:* Woodturning tools require more frequent sharpening because the wood passes at a great speed. To maintain a clean cut, the sharpness of the tools edge must be

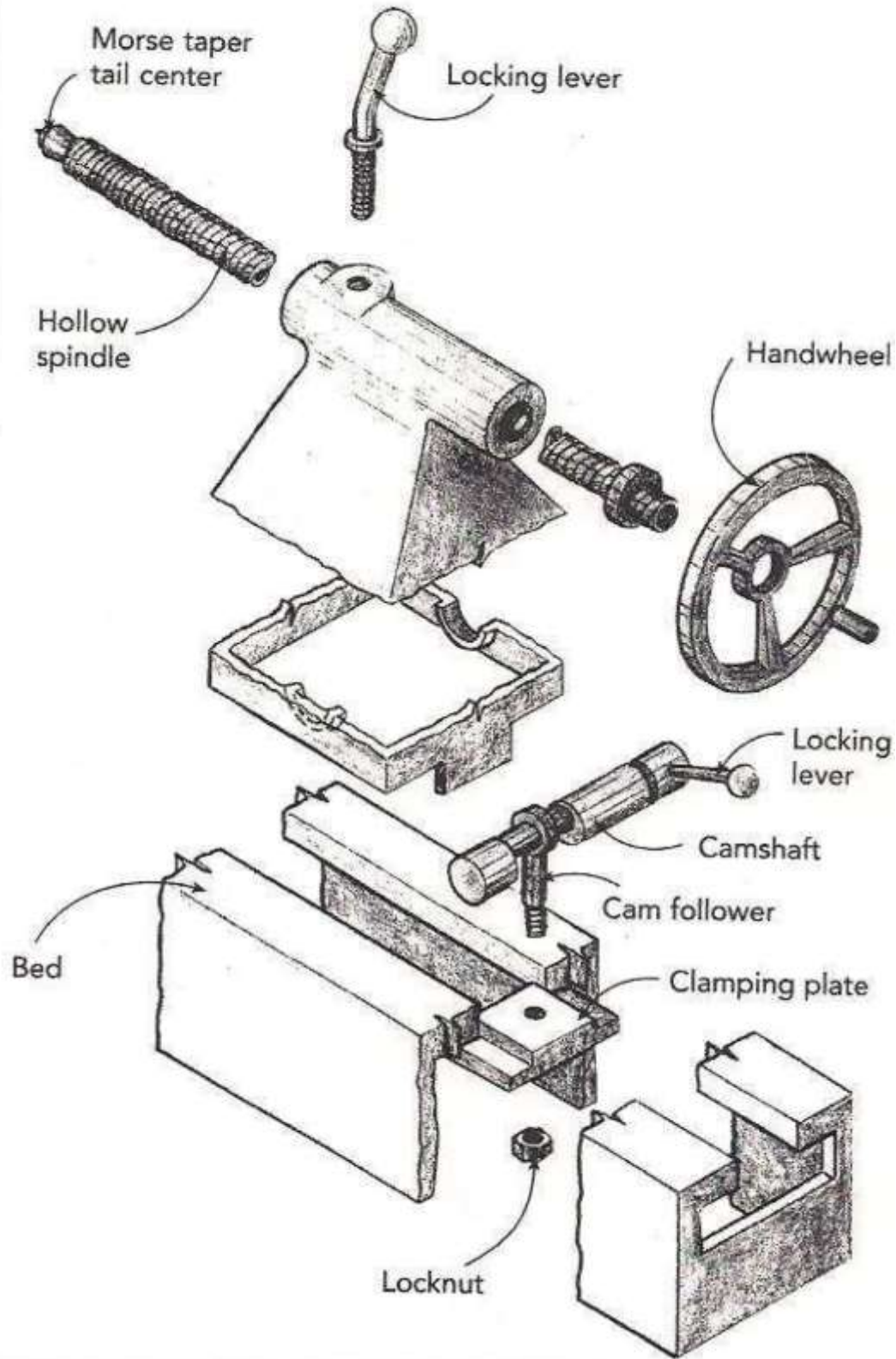
maintained. The sharpening process requires either skill of the craftsman, or one of the many available sharpening jigs, which facilitate maintaining a specific bevel on the tool.



THE HEADSTOCK



THE TAILSTOCK



Turning Tools

Each of these tools comes in a variety of styles, sizes, and lengths. There are two types or styles of lathe turning techniques—either scraping or cutting. Use the method that you feel comfortable with. The scraping method gives a rougher cut and requires more sanding. The cutting method requires more practice but gives a smoother cut with less tear outs of the grain. Whether you scrap or cut, the sharper your tools the better your results will be. So learn how to sharpen our lathe tools and keep your tools sharp.

1. Gouges

- a. **Roughing gouge**—used to round off square stock. DO NOT USE with faceplate turning.



- b. **Deep fluted bowl gouge**—used to make concave cuts and scrape inside bowls.



c. **Bowl gouge**—shallow fluted spindle gouge or detail gouge.



2. **Parting or cutoff tool**

Used to make narrow cuts to a given depth or diameter. It is also used to cut off a finished turning from waste stock.



3. Skew chisel

Used to smooth straight cylindrical stock. It can also be used to make V cuts, round beads, and other convex surfaces.



4. Square nose chisel

Used to smooth straight cylindrical surfaces both in spindle and faceplate turning.



5. Round nose chisel

Used to form concave surfaces; it can also be used to scrape the inside of bowls.



6. Spear point chisel

Used for bead and V cutting.



Basic Safety Check for all turning operations:

1. Wear a full-face shield while rough cutting. Approved safety glasses must be worn during all lathe operations other than rough cutting. Although not mandatory, it is highly recommended that a fullface shield be worn during all lathe operations.
2. Don't wear loose clothing, gloves, jewelry, or long sleeves. An approved turning smock with long sleeves is authorized.
3. Tieback long hair.
4. Use only sharp Tools. Sharpen the tools as necessary.
5. Use only wood with no defects, i.e. no splits or loose knots.
6. Mount wood safely between centers or on to a face plate.
7. Calculate your operating speed by checking the speed chart. Generally the smaller the piece, the higher the speed and vice versa.
8. Adjust the tool rest to 1/4" below the center line for cutting and 1/8" above the center line for scraping.
9. Try to keep the tool rest 1/4 to 3/8" from the turning wood.
10. Turn the piece by hand to make sure it clears the tool rest and bed of lathe.
11. Stand to the side of the stock when first starting the lathe.
12. Use the tools correctly and take light cuts.
13. If you are unsure, ask for help from a person who is familiar with lathe turning.

Preparing the Lathe and Stock for Spindle Turning:

1. Select the stock. Using a piece of stock less than 3" square avoids cutting the corners off to make the piece octagonal. A stock larger than

a 3" square should be cut into an octagonal shape to reduce vibrations and ease the roughing cut.

2. Locate the center of both ends of the piece and mark them with an X. On the end piece that attaches to the head stock, cut an X about 1/4" deep with a handsaw.
3. Place the spur center into the X kerf and strike it with a mallet to seat it into the wood.
4. Slide the spur center into the head stock and attach the cup center which is located on the tail stock firmly into the wood by turning the handle.
5. Check and adjust speed using the speed adjustment dial on the headstock.
6. Turn the piece by hand to make sure it clears the tool rest and bed.

Turning the Wood to a Cylinder

To turn square stock into a cylinder begin with a roughing gouge set on the tool rest about 2" in from the tail stock so that the cutting surface is oriented like the letter "U." While you are rubbing the bevel, turn the gouge tip to the right so that the cutting edge is oriented like the letter "C." Now raise the handle of the roughing gouge slightly so that the tool begins to peel away stock. By doing so a shearing cut can be taken and the width of the cutting edge that is in contact with the stock is maximized. Make the cut toward the tail stock. Make a couple of light cuts, then move the tool about 2" to the left toward the head stock and repeat the cuts toward the tail stock. When you have about 2" left to be cut, turn the tool to the left and cut the remaining stock toward the head stock. Get the feel for the tool.

NOTE: Keep moving the tool rest in to keep the 1/4" to 3/8" distance from the stock.

Continue cutting until the correct diameter and shape is obtained. You may use calipers or other measuring devices to check the size.

Smoothing Cylinder

A skew is normally used next to smooth the cylinder. This can be done by cutting or scraping. To scrape the piece, adjust the tool rest 1/8" above center, and hold the tool parallel to the work piece. Slide the tool into the wood and away from the point of the tool. Only the lower 1/3 of the cutting edge including the lower point must be used to avoid catching the wood with the pointed tip of the tool.

Another use for the skew is the peeling cut. In this technique only the center of the skew's cutting edge does the cutting because only the center of the cutting edge makes contact with your stock. When peeling, the center of the cutting edge is kept just below the top

surface of the round stock you are peeling. Start by placing the shaft of the skew chisel against the tool rest so that the bevel of the cutting edge is resting on the spinning stock. This is called rubbing the bevel. Now pull the tool towards you a bit and raise the handle slowly so that the center of the cutting edge begins to peel away stock. As the cutting edge peels, the handle is raised to follow the cut and the tool is moved along the tool rest either from left to right or from right to left. This cut is to be used only on round stock. The skew can also be used to produce V cuts and beads.

Cutting Different Shapes

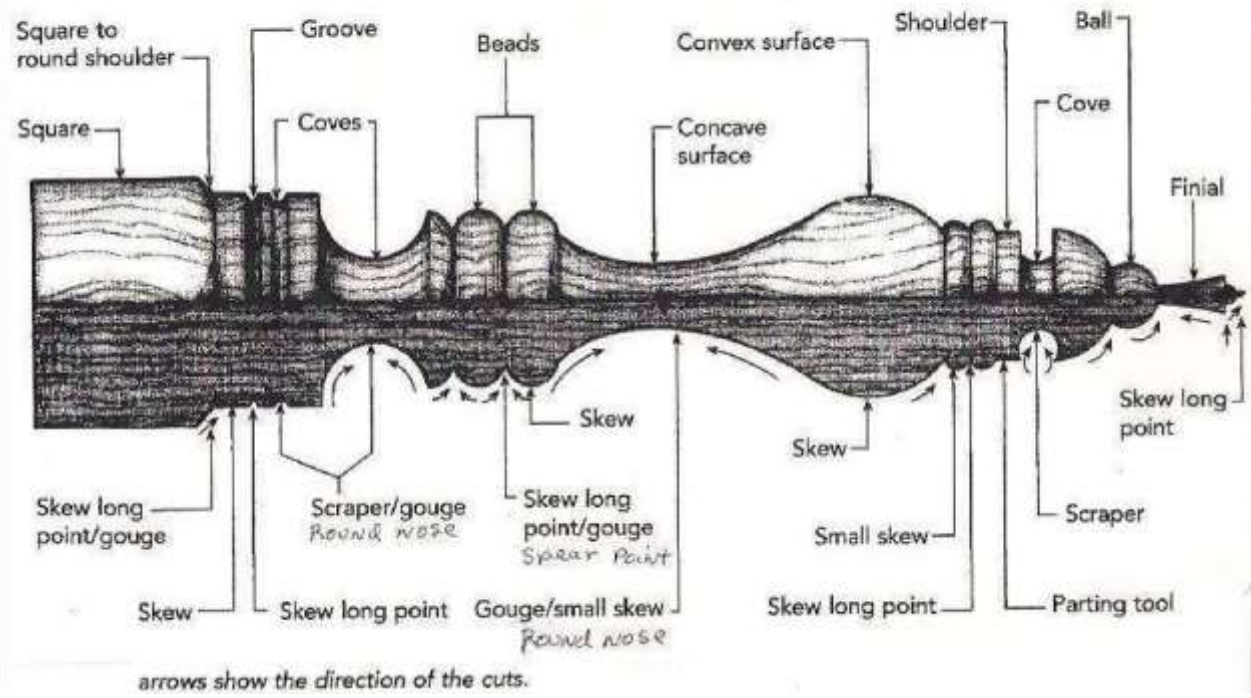
* *Cutting coves*—Mark the wood where you want the coves. To scrape use a round nose tool and force it into the center of the cove. Swing the tool from side to side using the tool rest as a fulcrum point. To cut coves using a gouge, lay the gouge on the tool rest with the flute facing the tail stock. Push the gouge into the wood and rotate until the flute faces up at the bottom of the cove. Reverse for right side facing head stock.

* *Cutting Vs*—Use a spear point to scrape Vs into the wood, or use a skew on edge with the long point down. Then force it into the stock at the center of the V. The skew is rotated down into the stock using the tool rest as a pivot. Cutting should be done by the long point. Work from one side of the V cutting into the heel of the skew. When satisfied, cut the opposite side in a similar manner.

* *Bead cuts*—Bead cuts or round cuts, may be made by using the skew or the spear point. When using the skew, follow the steps in cutting a V listed above. Then turn the skew on its side and make a round motion to form the bead. To make a bead using a spear point, push the spear part tool straight into the piece and then rotate it horizontally to form the bead.

Centerwork Speeds for Even=Grained Blanks:

EXTERNAL SHAPES AND TOOLS



Diameters	Lengths					
	6 in 150mm	12 in. 305mm	18 in. 460mm	24 in 610 mm	36 in. 915mm	48 in. 1,220mm
1/2 in. 13 mm	2,500	2,100	1,500	900	700	700
2 in. 50 mm	2,000	2,000	1,500	1,250	700	700
3 in. 75 mm	1,750	1,250	1,000	900	700	700
4 in. 100 mm	1,250	900	700	700	700	700
5 in. 125 mm	1,000	900	700	700	700	700
6 in. 150 mm	900	700	700	700	700	700

The figures in this chart are expressed in rpm. For safety, unevenly grained or unbalanced blanks should be started at half these speeds.

Maximum and Minimum Turning Speeds

The formulas to determine the maximum and minimum turning speeds are:

$$\frac{\text{Maximum Speed}}{\text{Diameter}} = \frac{9000}{\text{Diameter}} = \text{??? RPM}$$

$$\frac{\text{Minimum Speed}}{\text{Diameter}} = \frac{6000}{\text{Diameter}} = \text{??? RPM}$$

Sanding

Sanding can be performed using a number of grits. Remember you need to remove the cutting marks and make the sanding lines small enough so that you can't see them. Start with 80 grit sandpaper and continue up through 220 or higher if needed. Remember to remove the tool rest. Take the sandpaper in your hand, fold if desired, and rub the sandpaper against the underside of the wood with your palm open facing up. Move the paper back and forth using a slow speed throughout the sanding process. Change grit size as needed.

Finishes

Various finishes can be applied to your finished project. Some can be applied while your project is still mounted on the lathe. Some of the possible finishes are wax, Danish oil, lacquer, shellac, (French polish) and polyurethane. Using paper to apply the finish is desired, but a maximum of a 3" x 3" piece of cloth can be used.