

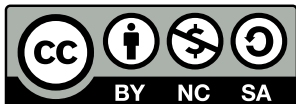
Protohaven

CLASS NOTES

Woodshop 107: Wood Lathe Intro

CLEARANCES

Wood Lathe



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Welcome

Welcome to the Introduction to Lathe class at Protohaven!

Shop Rules

Be Safe

- Get safety clearances
- Wear protective equipment
- Watch and reset equipment after use
- Never use equipment that is red-tagged

Take Care of Each Other

- Be aware of your surroundings
- Don't use a tool if it poses a danger to someone else

Take Care of the Tools

- Get tool clearances
- Do not alter or use equipment beyond limits
- Notify staff when maintenance is needed

Keep the Shop Clean

- Clean up after yourself
- Return tools to their original locations

Tool Status Tags

Every tool at PH has a status to let you know if the tool is safe to use.

If the tool status is *green*, the tool is safe to use. All features should be expected to work, and no extra care should need to be taken while using the tool.

If the tool status is *yellow*, the tool may still be used, but with extra caution. The information on the physical tag or in the online maintenance history will indicate what special care needs to be taken while using the tool. If the physical tag and the maintenance log disagree, alert a tech.

If the tool status is *red*: **DO NOT USE THE TOOL**. The tool is not safe to use. The information on the physical tag or in the online maintenance history will indicate what fixes are pending, and when a repair is expected.

Some tools in the shop are explicitly green tagged to let you know they are working. Other tools in the shop are not explicitly green tagged when they are working to reduce sign fatigue. If you are in doubt about the status of a tool with no visible tag, check the Protohaven website for the tool status page:

<https://www.protohaven.org/equipment/>

Filing a Tool Report

If you are using a tool, and the tool becomes unsafe, damaged, or is not working properly, you must notify a tech. The tech may instruct you to submit a tool report:

<https://airtable.com/appbI10R1mbIxNU1L/shr1uff2WSzy8c3xd>

Notifying the tech will help us keep signage up to date, and make sure the users who come in after you have all the information they need to use the tool safely, even if they don't use discord.

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Safety

If you feel unsure of something, feel free to ask!

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Introduction

Learning Objectives

TODO

Terminology

TODO: what other glossary terms are needed here (that are not covered in the tool anatomy section)?

- burl** A burl is an unusual growth on a tree, producing swirls and other interesting grain patterns.
- heartwood** Heartwood is the fully developed wood surrounding the core, usually darker than sapwood and very dense.
- sapwood** Sapwood surrounds heartwood and is usually softer. It transports sap from roots to leaves. Sapwood has a different color than heartwood.
- spalted** Spalted wood is in the process of fungal decay that shows as black lines in the grain. Woodturners prize spalted wood because the black lines add an artistic element to the turning.

Tools

Lathe

Usage Notes

Safety

The following equipment is required while working at the lathe:

- Hearing protection
- Closed-toed shoes
- An industrial quality Face Shield

A well-fitting dust mask is also required for sanding.

Loose sleeves must be rolled up and long hair and scarves must be tied back. Avoid any dangling drawstrings or other articles of clothing that may come in contact with the lathe.

- Ensure that your piece is secure and mounted appropriately
- Wear a face shield and a well-fitted dust mask, especially while sanding
- Immediately stop turning if there is excessive vibration or a piece becomes loose

Common Hazards

The most significant safety hazard is getting a body part caught in the lathe and being drawn into the machine while it is rotating. This is a potentially deadly hazard and should be carefully avoided by:

- Wearing the proper clothes (nothing loose or dangling that can get wrapped around the workpiece or chuck)
- Positioning the tool rest properly (keep a good cutting angle, and keep your weight away from the lathe)
- Using break-away materials when sanding and finishing (e.g., applying finish with a paper towel instead of a cloth rag)

The most common hazard is material breaking off of the lathe and impacting the user. Stop turning immediately if there is excessive vibration or a piece becomes loose. This hazard can be minimized by:

- Wearing appropriate PPE
- Properly securing materials
- Turning at the proper speed
- Carefully turning glue-ups or potentially weakened materials

Pinching between the tool rest and the turning tool is also a common hazard, caused when the tool makes contact with the piece before being properly placed on the tool rest. Avoid this by always placing the tool against the tool rest, then feeding it into the turning piece.

While not a primary safety concern, woodturning *catches* can be frightening and result in damage to your workpiece, or in extreme circumstances, can cause a piece to break from the lathe. Catches are a part of woodturning and require time and practice to minimize.

Prohibited Materials

Do not use the wood lathe to turn:

- Rotted or split wood
- Improperly glued-up workpieces
- Off-center workpieces at high speed
- Metal

Rotted wood, split wood, and improperly glued-up workpieces have the potential to break apart while turning.

Off-center workpieces can cause excessive vibration, and may break loose while turning. Secure off-center workpieces carefully, and turn them at lower speeds.

Turning metal is inappropriate on the wood lathe. Use the metal lathe in the machine shop for turning metal workpieces.

Care

Stop use if you hear scraping or grinding sounds from the machine. This may indicate the machine requires immediate maintenance.

Beware of impacts on the tool rest. The tool rest should be smooth, and free of bumps and dips.

Parts of the Lathe

Full View

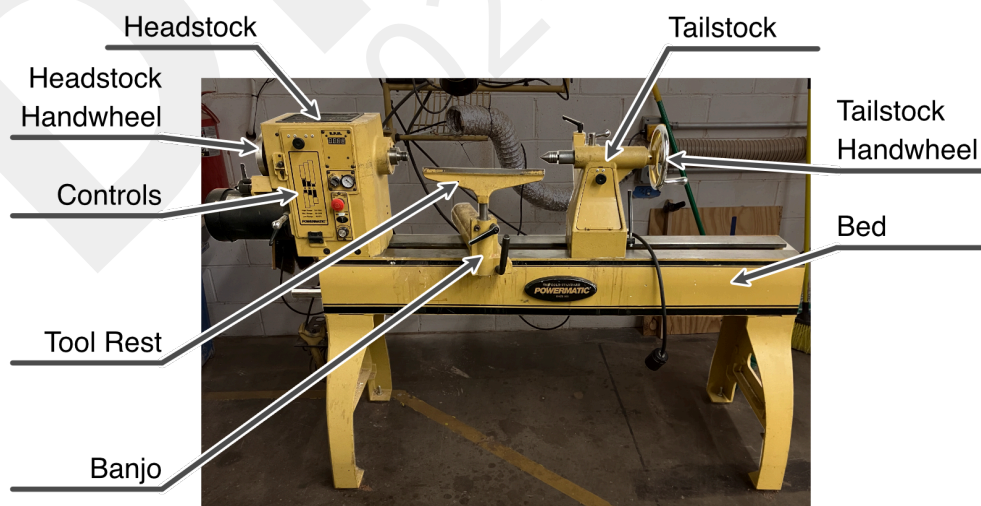


Figure 1: Front view of the lathe.

Lathe Controls

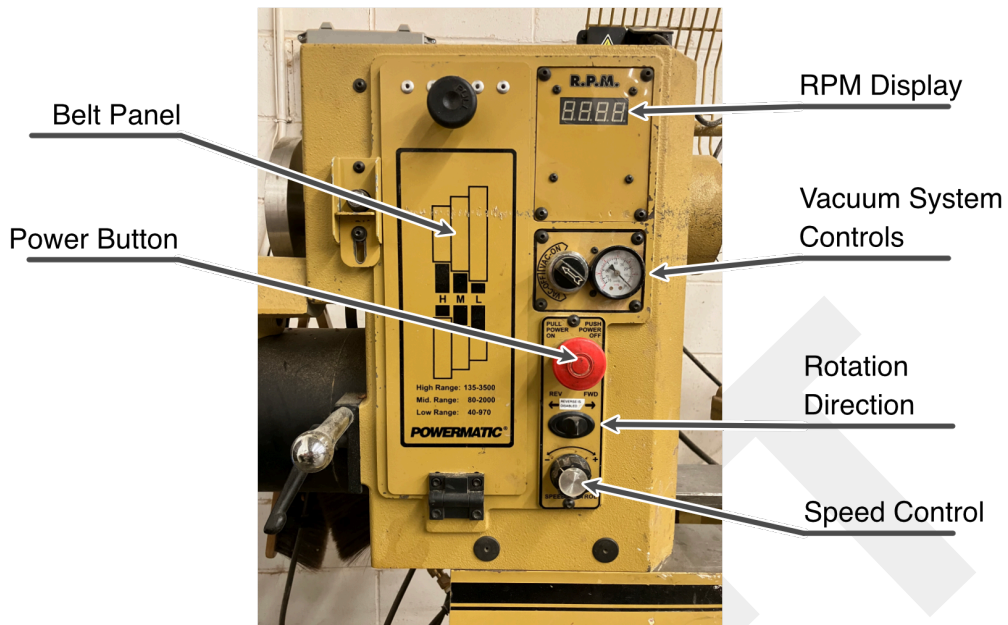


Figure 2: The lathe control panel.

Accessory Kit



Figure 3: Contents of the lathe accessory kit.

On/Off Switch and Emergency Stops

Pull the red power button to turn on the lathe.

Push the red power button to turn off the lathe.

The lathe has two emergency stop buttons. The red power button on the head stock doubles as an emergency stop. The lathe also has a remote emergency stop attached to the power supply. The remote emergency stop has a magnetic base, and can be attached to the lathe body where convenient.

Banjo

The banjo is an adjustable metal bracket that is mounted on the lathe bed. The banjo has a movable arm that can be adjusted to hold tools and accessories at different

angles and distances from the workpiece. The banjo is commonly set up to hold a tool rest, used to support a tool while turning.

Bed

The bed supports and aligns that various components of the lathe.

Calipers

Calipers are useful to check if the workpiece has been turned down to a required size. Calipers are available in the accessory kit.

Chuck and Jaws

A device that holds the workpiece on the lathe. Always use an appropriate chuck to safely and securely hold a workpiece for turning. Various jaws suitable for various sized workpieces are available in the accessory kit.

Drive Belts

The drive belts can be adjusted to change the range of RPMs at which the lathe can spin the workpiece.

Drive Center

A drive center attaches to the workpiece and spins it for turning. Drive centers are used for spindle turning, with the workpiece secured between the drive center and the tailstock.

Faceplate

A device that holds the workpiece on the lathe.

A faceplate is mechanically connected to the workpiece by clamps, fasteners, or other means. The faceplate is then connected to the drive of the lathe to turn the workpiece. Faceplates are more complicated to set up than drive centers or chucks, but are very flexible, and can be used to mount a wide variety of workpiece shapes and sizes.

Headstock

Provides the drive for the workpiece, usually through pulleys connected by a belt to the drive motor of a lathe.

Headstock Hand Wheel

Use the headstock hand wheel to rotate the workpiece manually in the lathe. Use the hand wheel to check workpiece clearances, or to slowly rotate the workpiece for visual inspection.

Lights

The lathe has several work lights attached to help illuminate the workpiece. More light can be very useful when turning fine details.

Live Center

A live center is often used in the tail stock to support the workpiece on both sides for spindle turning. The live center should turn freely in the tailstock, without catching or binding.

Speed Controls

Use the speed controls to adjust the revolutions per minute (RPM) of the lathe.

Spindle Lock

Engage the spindle lock to keep the spindle from turning. This is an important safety feature to make sure the lathe will not spin in between turning operations.

Tailstock

The movable assembly opposite the headstock that slides along the lathe bed and supports workpieces.

Tailstock Handwheel

Use the tailstock handwheel to advance or retract the spindle on the tailstock.

Tool Rest

The tool rest is an adjustable bar that steadies and supports a turning tool while it is engaged with the workpiece.

The tool rest should be adjusted to that is as close the workpiece as possible. Once setting and locking the tool rest into place, manually rotate the workpiece to make sure it turns freely, and does not contact the tool rest.

Vacuum System

The lathe has a vacuum system to mount delicate, low-clearance workpiece to the drive spindle.

Turning Tools

Turning Tool Materials

Turning tools are commonly equipped with steel or carbide cutting tips.

Tools with steel cutting tips can be resharpened and reshaped as needed.¹

Carbide tools use a small, replaceable tip of carbide for their cutting edge. Carbide is a very hard material that keeps a good edge for a long time, but can easily chip.

Turning Tool Types

For **spindle** turning:

Roughing gouges are wide, u-shaped fluted turning chisels used to hog off large amounts of material from the workpiece. They are available in many shapes and sizes.

Spindle gouges are thinner, more delicate fluted turning chisels meant to apply fine detailing to the profile of the workpiece. They are available in many shapes and sizes.

¹Do not reshape the tools in the accessory kit.

Skew chisels are turning chisels meant for fine finishing and planing of the workpiece. Skew chisels are available with a right- and left-handed skew.

Parting tools are used to divide the workpiece, often paring away material at the end of the workpiece prior to removal.

For **bowl** turning:

Bowl gouges are heavy deeply fluted chisels for turning the inside and outside of a bowl.

Scrapers use a burr to scrape the surface smooth. They are useful for scraping fine finishes in the interior of a bowl.

Turning Speeds

Turning pieces at the proper speed will help ensure better results with greater safety. In general, use lower speeds for roughing and for long or large diameter work. Turn smaller pieces at higher RPMs and larger pieces at lower RPMs. This is not an exact science, so always begin turning a piece at close to the recommended RPMs (see Table 1), increasing speed only if necessary.

Workpiece Diameter	Roughing RPM	Cutting RPM	Finishing RPM
Under 2"	1500	3000	3000
2"-4"	600	1500	2300
4"-6"	450	1100	1500
6"-8"	450	600	1100
8"-10"	450	600	850
10"-12"	450	600	850
12"-14"	450	450	600

Table 1: Recommended turning speeds.

Basic Operation: Spindle Turning

Setting up

1. Engage both emergency stops.
2. Set the speed control to zero.
3. Slide the tailstock and banjo away from the headstock.
4. Install a drive center, faceplate, or chuck to accept the workpiece.
5. Secure the workpiece in the lathe with a center in the tailstock.
6. Set the brakes on the tailstock arm and lathe bed to lock the tailstock in place.
7. Adjust the tool rest to the appropriate height, and leave a 1/8" gap between the tool rest and the workpiece.

8. Rotate the workpiece one full rotation by hand to make sure the workpiece does not impact the tool rest.
9. Set the brakes on the banjo and tool rest.
10. Place turning tools within easy reach.
11. Secure loose clothing, tie back long hair, and put on PPE.

Workholding

Ensure that the workpiece is firmly secured in the lathe. If using a chuck, make sure the chuck is making good contact with the workpiece, and is properly tightened. If using spindles, make sure the spindles have good contact with the workpiece, and will not wander, or escape the workpiece.

Spindle Turning

1. Release the emergency stops.
2. Stand outside of the direct line of rotation for the workpiece.
If something goes wrong, and the workpiece is ejected from the lathe, do not stand where the workpiece will go. Make sure you and any others are clear of the area.
3. Turn on the lathe, and slowly ramp up RPMs to the proper speed.
Watch for vibration, loosening of the piece, or other hazards before beginning turning.
4. Round the workpiece with roughing tools.
5. Shape the workpiece with cutting tools.
6. If you are sanding the workpiece:
 - a. Turn off the lathe.
 - b. Remove the tool rest.
 - c. Run the lathe at slow speed.
 - d. Apply sandpaper with light pressure.
Do not put so much pressure on the paper that you might fall into the lathe. If using a strip of paper around the workpiece, do not grip it so tightly that it could pull you into the lathe.
7. If you are finishing the workpiece:
 - a. Turn off the lathe.
 - b. Remove the tool rest.
 - c. Run the lathe at slow speed.
 - d. Apply finish with a paper towel, using light pressure.
Do not put so much pressure on the paper towel that you might fall into the lathe.
8. Remove the piece with a parting tool:
 - a. Part the piece down to a thin spindle.
 - b. Turn off the lathe.
 - c. Use a handsaw to cut away the remaining wood to finish the removal.

Cleaning Up

Woodturning generates a lot of wood chips and sawdust. Give yourself extra time, especially before the shop closes, to ensure you have enough time to fully clean the lathe area.

1. Wipe any finish or other waste from the lathe as needed: check the bed, tool rest, center(s), chuck, faceplate, and banjo.
2. Sweep up chips and place in a trash can.
3. Sweep and/or vacuum the lathe to remove any chips and dust.
4. Retract the live center into the tailstock housing if needed.
5. Remove the drive center with a rod hammer, or remove the chuck, faceplate, or adapter as appropriate.
6. Return all accessories to the Lathe Kit.
7. Clean the carbide tools of any chips or sawdust and return them to their case.
8. Push the tool rest in close to the lathe so it won't catch on anything passing by the lathe.

If there are any waste pieces large enough to be recycled, place them in the back recycling bin.

Basic Operation: Bowl Turning

Setting up

1. Engage both emergency stops.
2. Set the speed control to zero.
3. Slide the tailstock and banjo away from the headstock.
4. Install a drive center, faceplate, or chuck to accept the workpiece.
5. Secure the workpiece in the lathe with a center in the tailstock.
6. Move the tailstock to the far end of the lathe bed.
7. Adjust the tool rest to the appropriate height, and leave a 1/8" gap between the tool rest and the workpiece.
8. Rotate the workpiece one full rotation by hand to make sure the workpiece does not impact the tool rest.
9. Set the brakes on the banjo and tool rest.
10. Secure loose clothing, tie back long hair, and put on PPE.

Workholding

Ensure that the workpiece is firmly secured in the lathe. If using a chuck, make sure the chuck is making good contact with the workpiece, and is properly tightened. If using a faceplate, make sure the faceplate is well secured to the workpiece, and is securely held.

Bowl Turning

1. Release the emergency stops.
2. Stand outside of the direct line of rotation for the workpiece.
If something goes wrong, and the workpiece is ejected from the lathe, do not stand where the workpiece will go. Make sure you and any others are clear of the area.
3. Turn on the lathe, and slowly ramp up RPMs to the proper speed.
Watch for vibration, loosening of the piece, or other hazards before beginning turning.
4. Round the workpiece with roughing tools.

5. Shape the workpiece with cutting tools.
6. If you are sanding the workpiece:
 - a. Turn off the lathe.
 - b. Remove the tool rest.
 - c. Run the lathe at slow speed.
 - d. Apply sandpaper with light pressure.

Do not put so much pressure on the paper that you might fall into the lathe.

7. If you are finishing the workpiece:
 - a. Turn off the lathe.
 - b. Remove the tool rest.
 - c. Run the lathe at slow speed.
 - d. Apply finish with a paper towel, using light pressure.

Do not put so much pressure on the paper towel that you might fall into the lathe.

Cleaning Up

Woodturning generates a lot of wood chips and sawdust. Give yourself extra time, especially before the shop closes, to ensure you have enough time to fully clean your area.

1. Wipe any finish or other waste from the lathe as needed: check the bed, tool rest, center(s), chuck, faceplate, and banjo.
2. Sweep up chips and place in a trash can.
3. Sweep and/or vacuum the lathe to remove any chips and dust.
4. Retract the live center into the tailstock housing if needed.
5. Remove the drive center with a rod hammer, or remove the chuck, faceplate, or adapter as appropriate.
6. Return all accessories to the Lathe Kit.
7. Clean the carbide tools of any chips or sawdust and return them to their case.
8. Push the tool rest in close to the lathe so it won't catch on anything passing by the lathe.

If there are any waste pieces large enough to be recycled, place them in the back recycling bin.

Resources

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