

Unit I – Common Power Tools

Lesson I: Safe Use and Maintenance of Power Tools for Woodworking

Many woodworking tasks in agricultural mechanics are done with power tools because their speed and efficiency can make woodworking tasks much quicker and easier. Before using power tools for woodworking, it is essential to be familiar with the parts and functions of the tools and to know how to operate them safely. This lesson identifies some common power tools (portable and stationary) and discusses safety precautions and maintenance procedures related to these tools.

Basic Procedures for Shop Safety

Each year many agricultural workers incur injuries while working with power tools. Unsafe use of power tools can result in injuries ranging from minor cuts and bruises to severe lacerations, finger amputations, and eye punctures from flying objects. Massive bleeding from severe injuries and electrocution can cause death. Tool operators sometimes add to the hazards by taking shortcuts to save time, disregarding warnings, not knowing how a tool works, and not using safety precautions appropriate for each tool.

The following are general safety procedures for working in a shop area. Safety precautions for specific tools are discussed later in this lesson.

- Adhere to instructions.
 - Read labels and warnings on containers and tools.
 - Follow the manufacturer's recommendations for use and maintenance of a specific tool.
 - Pay attention to signs posted in the work area.
 - Follow the instructor's directions.
- Wear safety glasses at all times in the shop.
- Wear protective gear such as gloves, earplugs, and safety shoes if appropriate.
- Do not wear loose-fitting clothing that could get caught in a moving part.
- Wear a hair net to prevent long hair from getting caught in a tool.
- Keep work areas clean and free of clutter.

- Inspect each tool before using it to make sure it is working properly.
- Tell the instructor about any damaged tool.
- Do not use a tool that is not working properly.
- Return each tool to its proper place of storage.

Common Sources of Power for Woodworking Tools

Power tools used in agricultural mechanics are powered by various means. Electricity, including battery packs, and compressed air (pneumatic power) are common sources of power for woodworking tools. In addition to the general safety precautions listed above, there are specific safety precautions for each of these types of power.

Safety Precautions for Electric and Pneumatic Power Tools

Electric and Battery-Powered Tools

- Always unplug a tool or disconnect it from its battery before inspecting it and making adjustments.
- Only use a tool that is double insulated or has a grounded plug.
- Always plug a tool into an outlet with a ground-fault circuit interrupter (GFCI or GFI). A GFCI will shut off the power if a short occurs. If an outlet is not equipped with a GFCI, a portable GFCI can be plugged into a grounded outlet.
- Do not stand on wet ground or a wet surface while operating an electric tool.
- Make sure stationary power tools are anchored to the floor.
- Make sure all guards and shields are in place and vents are clear of debris before turning on a tool.
- Do not bend the power cord sharply, do not use the cord to pull the plug from the outlet, and do not use the cord to carry the tool. Such actions could break the cord. A broken power cord could cause an electrical shock.
- Use only the battery specified by the manufacturer for the tool being used.
- Use only the type of recharger designed for the batteries being used.

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- Always store battery packs safely so that no metal can come in contact with the terminals. This can short-circuit the battery and cause sparks, fire, or burns.

Pneumatic Power Tools

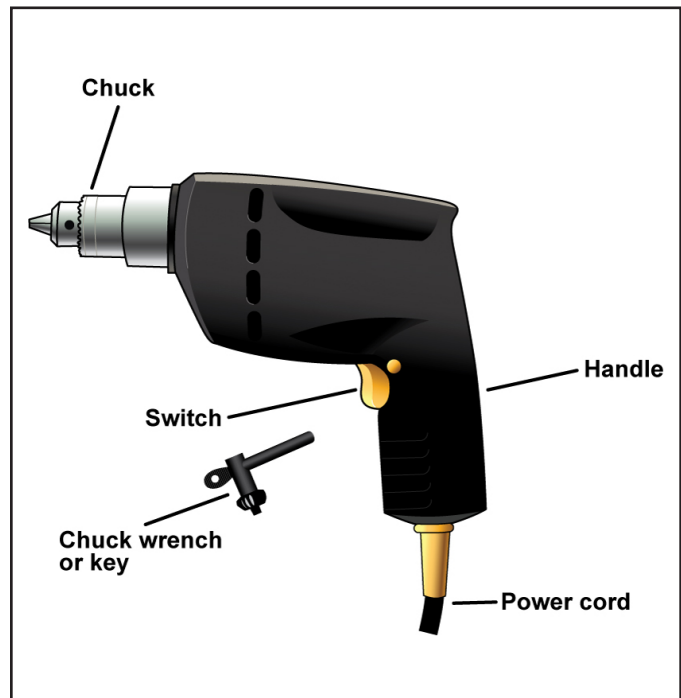
- Disconnect pneumatic tools for all inspections and adjustments.
- Do not join or separate quick-disconnect couplings on high-pressure lines when bystanders are nearby.
- Do not use compressed air for cleanup if the air pressure is 30 lb per sq in. (psi) or greater.
- Do not point an air stream at anyone. High-pressure air can drive dust into the eyes, damage eardrums, or cause other injuries.
- Check couplings and air lines for evidence of wear and damage.
- Make sure air tanks and lines are free of moisture and appropriate filters are in place.
- Follow the manufacturer's recommendations for hose size and maximum air pressure.
- Oil pneumatic tools regularly according to manufacturer recommendations.

Portable Drills

Portable power tools, such as a drill, are particularly useful because they can easily be taken to the job site, do not require extensive setup, and are relatively affordable. Main parts of a portable drill include an on/off switch, power cord, handle, chuck (the part that holds the drill bit), and chuck key. See Figure 1.1. A chuck key is used to loosen and tighten the chuck. Portable drills are used to do various woodworking jobs, such as drilling and boring, driving and removing screws, and operating hole saws. Drills can also be used for sanding and polishing wood.

Portable drills come in different sizes. The size of a drill is based on the maximum size of drill bit that the chuck will hold. For example, with a 1/4-in. drill, the chuck holds a bit with a shank that is no larger than 1/4 in. Some drills have only one motor speed while others have different speeds. Variable-speed drills are useful for driving screws. Screws can be removed by using the reverse setting.

Figure 1.1 – Portable Drill



Safety precautions for a portable drill include the following:

- Choose the right drill bit for the job. For example, do not put a square-shank bit in an electric drill.
- Make sure the bit is tight in the chuck. Use the key in each hole of the chuck to tighten the bit. Be sure to remove the chuck key before starting the drill to avoid throwing the key.
- Make sure work is held securely in place. Use a clamp or vise to hold a small piece of work.
- Hold the drill perpendicular to the work to avoid binding the bit.
- Remove the bit from the drill after completing the job.

Basic maintenance procedures for a portable drill include the following:

- Keep parts lubricated according to the manufacturer's instructions.
- Sharpen or replace dulled drill bits.

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Portable Circular Saws

Portable circular saws are available in different sizes. Main parts of a circular saw include an on/off switch, power cord, angle scale (used for setting the depth of the blade's cut), base, angle adjustment lock, handle, blade guard, and blade. See Figures 1.2 and 1.3. The size of a circular saw is determined by the diameter of the largest blade it will hold.

Figure 1.2 – Portable Circular Saw

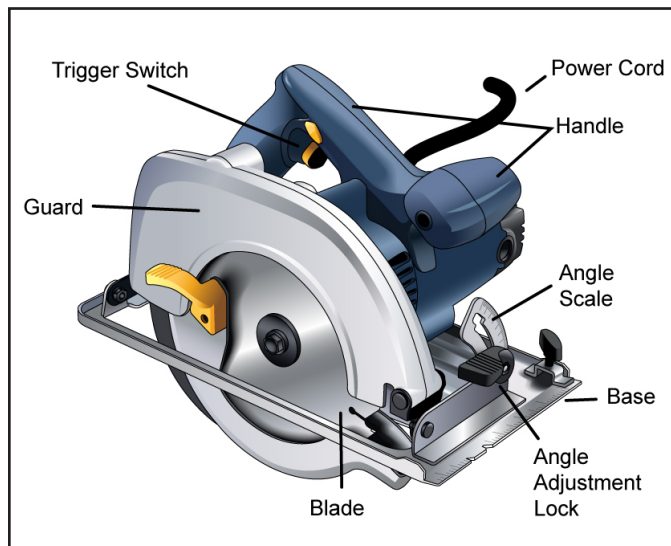


Figure 1.3 – Using a Circular Saw



As the saw's name suggests, the blade of a circular saw is round and it spins in a circle during cutting. Circular saws are commonly used for making rip cuts, crosscuts, bevel cuts, and angle cuts for mitering. Different types of blades are used for different kinds of cuts. For example, a blade with large teeth may be chosen for fast, rough cutting and a blade with small teeth may be chosen for finer cutting. The blade can be adjusted to cut at different depths. Because the blade rotates upward, splintering occurs on the topside of the piece. For this reason, the best side of the piece should be placed face down when sawing with a circular saw.

Safety precautions for a portable circular saw include the following:

- Choose the right blade for the cut.
- Make sure base and angle adjustments are correct for the cut and are tightly in place.
- Back the saw slightly away from the work before turning it on.
- Allow the saw to reach full speed before beginning to cut.
- Cut only in a straight line to avoid binding the blade.
- Wait until the blade stops moving before setting the saw down.

Basic maintenance procedures for a portable circular saw include the following:

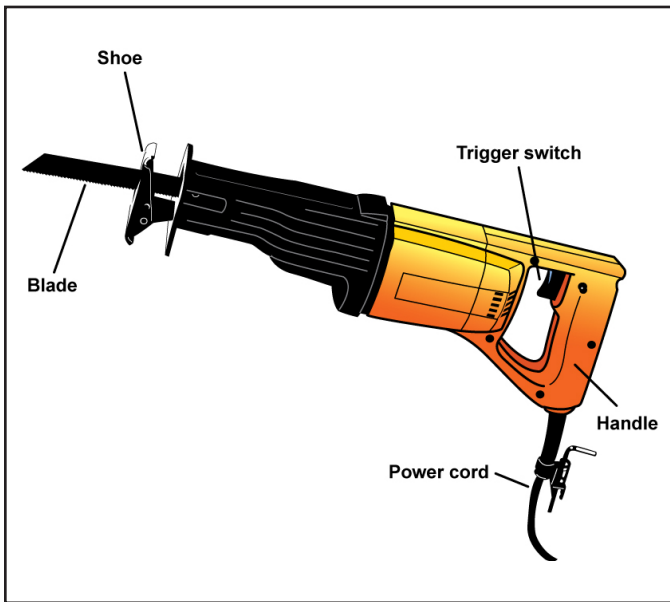
- Make sure the blade guard always moves freely. Small pieces of wood can become caught in the blade guard, preventing it from covering the blade properly when the saw is not in use.
- Clean, sharpen, or replace blades that are gummy or dull.

Reciprocating Saws

A reciprocating saw is another common portable power tool that is useful for work in close areas where it would be difficult to operate a circular saw. Main parts of a reciprocating saw include an on/off switch, power cord, handle, shoe, and blade. See Figure 1.4. With this saw, the blade moves up and down. The shoe is placed against the work for stability. The shoe can be adjusted in or out to

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Figure 1.4 – Reciprocating Saw



Basic maintenance procedures for a reciprocating saw include the following:

- Follow the manufacturer's recommendations for regular service.
- Inspect and replace blades as needed.

Band Saws

A band saw is a large machine that must be anchored to the floor. Main parts of a band saw include an on/off switch, upper and lower wheels and wheel guards, table, upper and lower blade guides, and arm. The wheels, guards, and blade guides are located above and below the table. See Figure 1.5. The blade is thin and forms a continuous loop that runs over the two wheels and through the two blade guides.

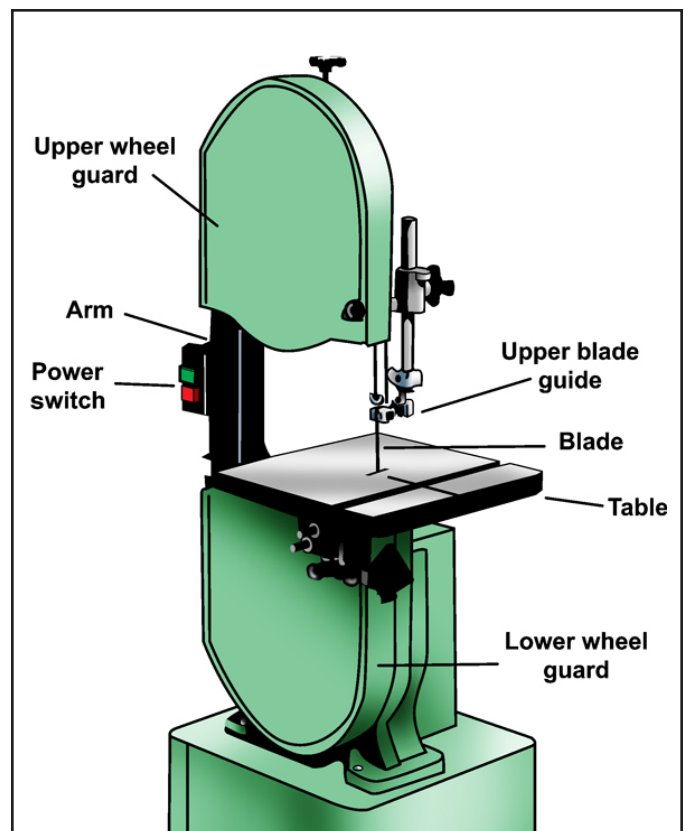
control the depth of the cut. Different kinds of blades can be used to make different types of cuts.

This heavy-duty saw can be used to make relief cuts, irregular cuts, crosscuts, and pocket cuts. Relief cuts are made in the waste portion of a piece, almost to the actual cutting line. Relief cuts can be a helpful step for creating curved edges in a piece. Pocket cuts are made at the edge of a piece to form a three-sided indentation, or pocket, at the edge. The blades for a reciprocating saw have a narrow and straight shape and are available in different types for cutting wood, metal, plastic, and plaster.

Safety precautions for a reciprocating saw include the following:

- Choose the right blade for the cut.
- Choose the right speed for the cut. Use a low speed to cut dense, hard material and a high speed to cut softer material.
- Make sure the saw is at working speed before cutting.
- Hold the shoe against the work at all times.

Figure 1.5 – Band Saw



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The size of a band saw is determined by the diameter of its wheels. For example, a 14-in. band saw has 14-in. wheels. Band saws can be used for making straight and irregular cuts, arcs, curves, and bevels. Band saw blades vary in width, thickness, teeth size, and teeth spacing. A narrower blade has fine teeth and is used for cutting sharp curves. A wider blade has coarse teeth and is used for cutting large curves.

Safety precautions for a band saw include the following:

- Use the right blade for the cut. Teeth should be pointing downward.
- Make sure the blade tension is tight.
- Place the guide within 1/2 in. of the work.
- Take special care in planning the cut, making sure that both the work piece and the waste piece of wood can be controlled so neither one hits the arm of the saw.
- Turn off the saw immediately if the blade “clicks” or breaks. A clicking noise could mean that the blade is cracked.
- Turn off the saw before backing out of a cut.

Basic maintenance procedures for a band saw include the following:

- Maintain proper blade tension.
- Maintain proper blade tracking. The blade should stay in the center of the wheels.
- Repair or replace broken blades.

Table Saws

A table saw works similarly to a portable circular saw, but it is much larger and is anchored to the floor. Main parts of a table saw include an on/off switch, blade height adjustment wheel, rip fence, miter groove, blade guard, table, and blade angle adjustment wheel. See Figure 1.6. This stationary saw is equipped with either a tilting table or a tilting arbor, which can be adjusted for making angle cuts. The blade is mounted in the tilting arbor. The rip fence acts as a guide for making straight cuts. A push stick is used for making rip cuts in narrow or short pieces. See Figure 1.7.

Figure 1.6 – Table Saw

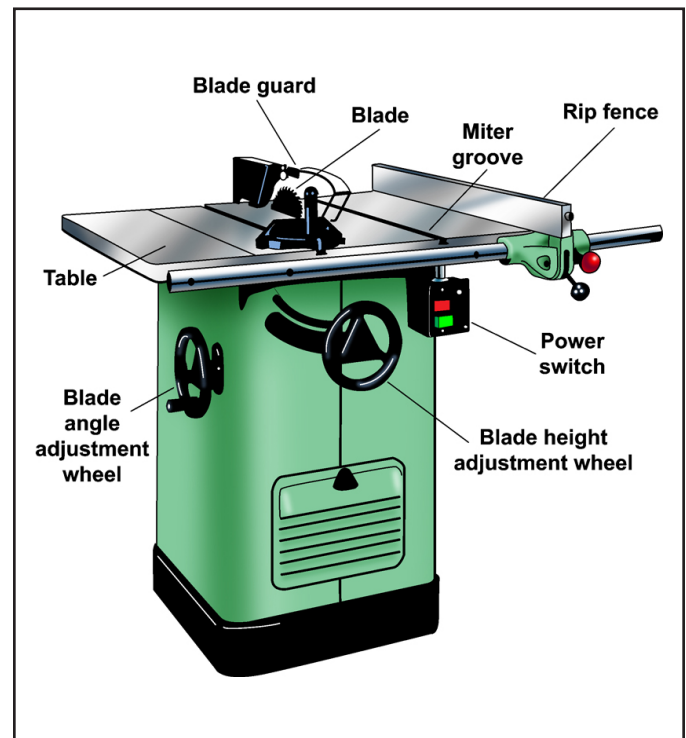
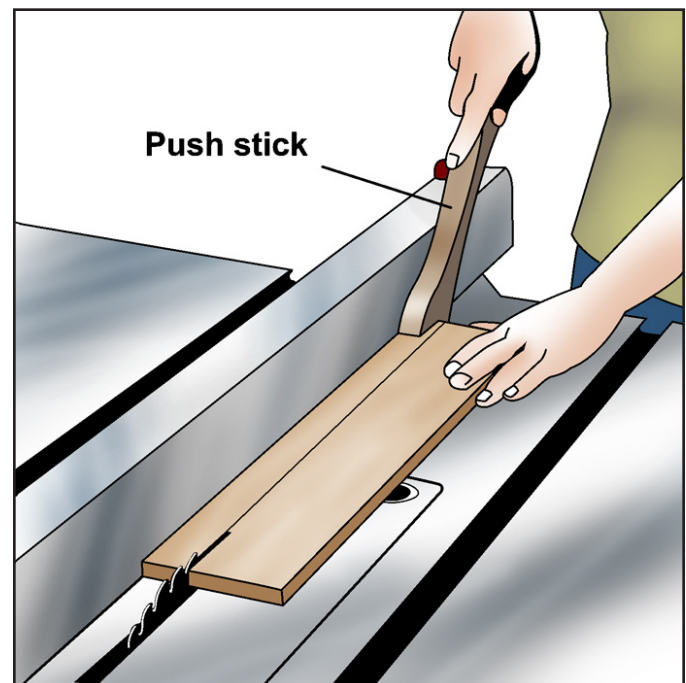


Figure 1.7 – Using a Push Stick When Cutting With a Table Saw



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Different types of blades are used for ripping, crosscutting, mitering, beveling, and joint making. Certain types of blades can perform special functions such as cutting dados. The size of a table saw is determined by the largest diameter of blade it can hold. An 8-in. saw is useful for cutting small pieces and a 10-in. or 12-in. saw is useful for cutting large pieces or making rough cuts.

Safety precautions for a table saw include the following:

- Check the blade. Make sure it is right for the cut and make sure the teeth point in the direction of the blade's rotation.
- Adjust the blade to the correct angle and height for the cut.
- Stand to the side of the blade and do not reach across the table.
- Keep hands at least 6 in. from the blade.
- Use a push stick for guiding small pieces.

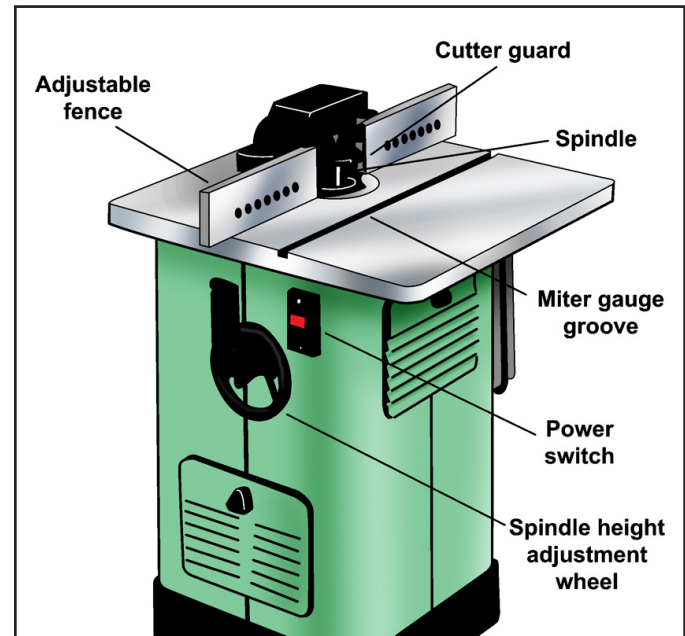
Basic maintenance procedures for a table saw include the following:

- Check the blade to be sure it is not warped.
- Regularly remove sawdust. A collection of sawdust could cause the motor to overheat.
- Use silicone or powdered graphite, not oil, on screw threads to keep them moving freely. With oil, screw threads could become gummed up with sawdust.
- Remove rust on unpainted parts with oiled steel wool.
- Remove excess oil after cleaning with steel wool and coat the area with paste wax.

Shapers

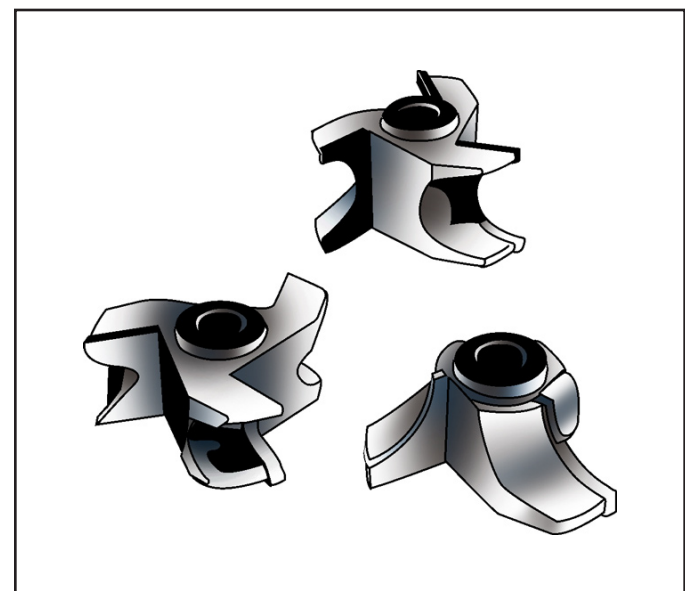
A shaper is a stationary power tool that is used for shaping edges, making moldings, and cutting joints. Main parts of a shaper include an on/off switch, spindle height adjustment wheel, miter gauge groove, spindle, cutter guard, and adjustable fence. See Figure 1.8. The spindle holds the cutter. The adjustable fence is used as a guide for straight cuts.

Figure 1.8 – Shaper



Cutters come in different shapes for making cuts of different patterns, including decorative edges. See Figure 1.9. The size of the shaper is determined by the diameter of the spindle.

Figure 1.9 – Examples of Different Cutters



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Safety precautions for a shaper include the following:

- Check all adjustments and locking nuts before using the machine.
- Check the rotation of the cutter and feed the work into the cutter opposite the direction of rotation.
- Make sure the piece has no warps or cracks that could cause it to be thrown.
- Always use proper guards and clamps.
- Use a holder or a push stick to guide the work when the piece is less than 1 ft in length.

Basic maintenance procedures for a shaper include the following:

- Follow the manufacturer's recommendations for lubrication. Oil is generally a good lubricant for areas where sawdust does not collect. Silicone is good for areas where sawdust collects.
- Inspect belts and follow the manufacturer's specifications for proper tension.

Jointers

Jointers come in different sizes and do functions similar to those of a hand plane. Small jointers are portable and large jointers are stationary. Main parts of a jointer include an on/off switch, infeed table adjustment levers, infeed table, tilting fence, cutter guard, cutterhead, and outfeed table. See Figure 1.10. The three main adjustable parts are the infeed table, tilting fence, and outfeed table. The outfeed table must be set at the same height as the cutter edges at the highest point of their rotation. See Figure 1.11. This adjustment is important to avoid tapering or biting the surface.

Jointers are used for planing edges and surfaces and for cutting bevels and chamfers. The jointer is equipped with a cylinder that holds knife blades. This cylinder is called the cutterhead. The length of the knife blades determines the size of the jointer and the maximum width of board it will cut.

Figure 1.10 – Jointer

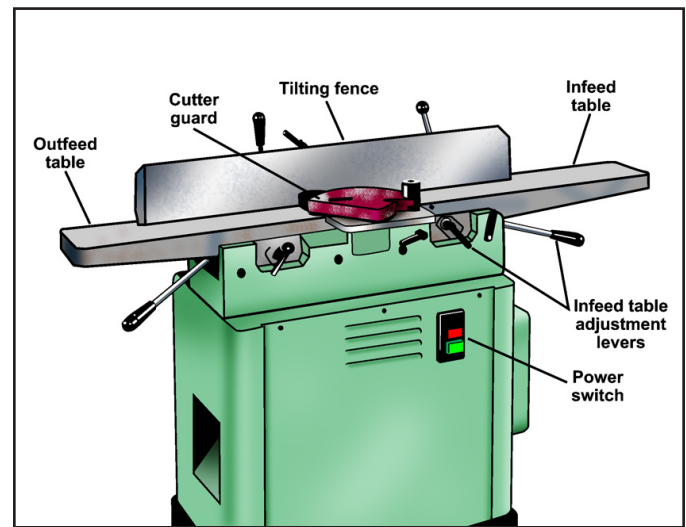
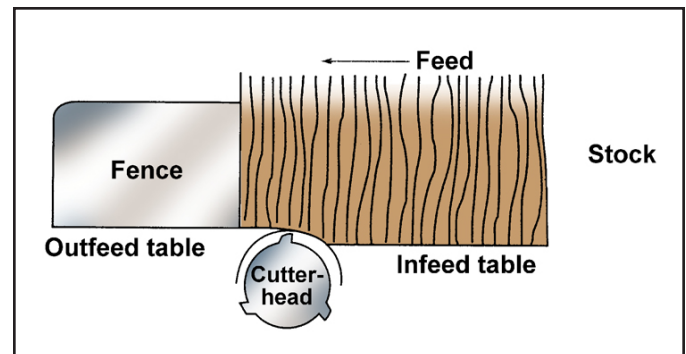


Figure 1.11 – Proper Adjustment of Outfeed Table on Jointer



Safety precautions for a jointer include the following:

- Make sure the table and fence adjustments are correct for the job. Do not exceed the recommended maximum cuts.
- Do not use the machine to work on a piece that is less than 12 in. long or less than 3/8 in. thick.
- Cut with the grain of the wood.
- Make sure the piece is free of knots and splits.
- Keep hands at least 6 in. from the cutterhead.
- Use a push stick and feather board when necessary.

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Basic maintenance procedures for a jointer include the following:

- Keep knives sharp. Dull knives can cause kickback.
- Follow the manufacturer's recommendations for lubricating the machine. It may be necessary to take some of the machine apart to reach places that require lubrication.
- Replace sealed bearings when they are worn.

Summary

Power tools can help make woodworking tasks quick, but they are dangerous. To prevent injury, users must follow general safety precautions and specific safety measures for each type of tool. Electricity, batteries, and compressed air are common sources of power for woodworking tools and there are general safety measures for electric and pneumatic power tools. Common portable power tools include portable drills, circular saws, and reciprocating saws. Larger stationary machines include band saws, table saws, shapers, and jointers.

Credits

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