

Lesson A3–4

Caring for and Reconditioning Construction Tools

Unit A. Mechanical Systems and Technology

Problem Area 3. Construction Systems

Lesson 4. Caring for and Reconditioning Construction Tools

New Mexico Content Standard:

Pathway Strand: Power, Structural and Technical Systems

Standard: VII: Develop skills required to use construction/fabrication equipment and tools.

Benchmark: VII-A: Use tools in the workplace to demonstrate safe and proper skills with construction/fabrication hand tools.

Performance Standard: 5. Identify and demonstrate proper hand and power tool maintenance procedures.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Discuss the selection of tool sharpening equipment.
2. Explain the sharpening of hand tools.
3. Discuss the replacement of tool handles.
4. Discuss the proper care and storage of tools.

List of Resources. The following resources may be useful in teaching this lesson:

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Herren, Ray V., and Elmer L. Cooper. *Agricultural Mechanics Fundamental & Applications*. Albany, New York: Delmar Publishers, 2002. (Text, Lab Manual, and Teacher's Manual—Units 20 and 21)

Phipps, Lloyd J., et al. *Introduction to Agricultural Mechanics*, Second Edition. Upper Saddle River, New Jersey: Prentice Hall Interstate, 2004. (Textbook, Chapter 6)

Other Resources. The following resources will be useful to students and teachers:

Burke, Stanley R. and T.J. Wakeman. *Modern Agricultural Mechanics*. Danville, Illinois: Interstate Publishers, Inc., 1992. (Textbook, Chapter 2)

List of Equipment, Tools, Supplies, and Facilities

- Writing surface
- Overhead projector
- Transparencies from attached masters
- Copies of student lab sheets
- Grinder
- Honing stone
- Files
- Tools to recondition

Terms. The following terms are presented in this lesson (shown in bold italics):

- Dressing tool
- Eye of the tool head
- Honing oil
- Honing stone or whetstone
- Jointing
- Quenching
- Reconditioning
- Temper

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

Display tools that are dull, rusty, and have broken handles. Ask students what needs to be done to make each tool useful. Ask students if they have any tools at home that need reconditioned. Reconditioning is the process of restoring a tool to a good condition.

Summary of Content and Teaching Strategies

Objective 1: Discuss the selection of tool sharpening equipment.

Anticipated Problem: What equipment is needed to sharpen tools?

- I. In order for tools to do quality work in a safe manner they need to be kept sharp and in good condition. Equipment needed to sharpen tools are a grinder, dressing tool, honing stone, honing oil, and files.
 - A. A bench grinder is used for rough sharpening and to give cutting edges the proper bevel. Equip the tool grinder with a medium and fine grinding wheel. Before grinding, adjust the tool rest to within $\frac{1}{8}$ or $\frac{1}{4}$ inch of the wheel. Wear goggles or safety glasses with side shields when using a grinder. A **dressing tool** is held on the tool rest and pressed solidly against the wheel to clean out the pores of the wheel, straighten the face of the wheel, and true the wheel (make it perfectly round). There is less tendency to form a wire edge on a tool, and a more uniform job of grinding is possible, when the grinding wheel turns toward the cutting edge being sharpened.
 - B. A **honing** or **whet stone** generally has a coarse and a fine side used to put a fine, keen edge on a tool after grinding. **Honing oil** is a light weight oil used to make the tool easier to hone.
 - C. Files can be used for hand sharpening. A three-cornered file is useful in sharpening a handsaw. A round file is used to sharpen a chain saw. A flat file can be used to sharpen shovels and mower blades.

Either of the recommended texts contain good information on tool selection. Have students read the appropriate chapters to fully understand this objective. Take students to the shop to see the grinder, honing stone, and files. Demonstrate how to use the dressing tool to dress the grinding wheel. Use TM: A3–4A to summarize the equipment used in sharpening tools.

Objective 2: Explain the sharpening of hand tools.

Anticipated Problem: What procedures are used to sharpen hand tools?

- II. Sharpening tools is a three step process: jointing, grinding, and honing. **Jointing** is holding a tool perpendicular to the grinding wheel to remove nicks in the cutting edge. If nicks do not exist, skip this step. To grind, adjust the tool rest to the desired grinding angle for the tool keeping the tool rest within $\frac{1}{4}$ inch of the wheel. Position the cutting edge so the wheel turns down into the cutting edge. To avoid grooving the grinding wheel, move the tool being ground back-and-forth against the wheel. **Temper** is the degree of hardness and strength of metal. Most tools are tempered during manufacture by quenching. **Quenching** is a process in manufacturing of quickly cooling metal to improve its useful qualities. During grinding, if the tool is overheated, it will turn blue and lose its temper or hardness. Keep a container of water handy to cool the tool as you grind. Finish the sharpening by moving the

tool back-and-forth, in a circle, or figure eight motion on the honing stone with a light coating of honing oil. Start on the coarse side of the stone and then finish the job on the fine side. Too much oil will cause the edge of the blade being sharpened to glide over the stone without contacting the abrasive material. After use, clean the stone under running water or with kerosene and dry off with a clean cloth or paper towel. If the honing stone is not cleaned after use, the oil and small metal particles will dry on the surface and clog the pores of the whet stone. Tools that are sharpened by filing must first be clamped or secured.

- A. Wood chisels are sharpened to a 25 to 30 degree angle. The correctly sharpened chisel will have a bevel twice as long as the thickness of the chisel. A plane bit is sharpened at the same angle and same way as a wood chisel. Jointing, grinding, and honing are generally all needed to sharpen the chisel and the plane bit.
- B. To sharpen a knife with nicks in the blade, joint, grind, and then hone. Knives in good condition may only need to be honed. For a keen edge, finish the knife using a butcher's steel. Some knives come with special sharpening stones that make sharpening easy.
- C. Cold chisels and center punches are sharpened to a 60 degree angle. Honing is not necessary. The head of the cold chisels and center punch is often mushroomed and should be ground so that the head is slightly smaller in diameter than the chisel or punch.
- D. Axes and hatchets need to be jointed and ground but honing is not necessary. Jointing is best done with a stationary grinder. Grinding may be done with the stationary grinder or with a portable grinder after clamping the ax or hatchet in a vise. If a grinder is not available use a flat file. Be sure the file has a handle and that leather gloves are worn.
- E. The hardest tool to sharpen is a twist drill. The cutting point is a 59 to 60 degree angle with a 12 degree clearance angle. A tool sharpening gauge will help grind the correct angle and keep the point of the bit precisely in the center of the bit. Twist drill sharpeners may be purchased.
- F. Sharpening handsaws is best left to a professional sharpener who has equipment that will insure that all teeth are the same size and perfectly sharpened. If you want to try sharpening, clamp the saw in a vise and sharpen every other tooth from the left side of the saw. Then move to the other side of the saw to sharpen the other half of the teeth.
- G. Sharpening chain saws can be done using a round file. Again sharpen every other tooth from the left side and then move to the right to sharpen the other teeth. Special holders can be purchased that will hold the file at the correct angle for sharpening.
- H. Standard screwdrivers with chipped or bent blades can be re-conditioned. Joint the blade to remove nicks and rounded edges. Then grind the sides of the blade until the tip is the correct thickness and until the sides are parallel for $\frac{1}{4}$ inch from the tip. Do not grind more than is necessary, because this weakens the screwdriver. The correct thickness of the tip is determined by the width of the tip. A screwdriver with a wide tip is made for a large screw.
- I. Sharpening shears, tin snips, and scissors is normally done with a flat file. Attempt to maintain the original angle. Scissors will be finished by honing, while honing is not necessary for shears and tin snips.

- J. Sharpening hoes, spades, and shovels is usually done with a flat file. Clamp the tool in the vise. Push the file across the sharp edge of the tool, being careful to maintain the original bevel. Remember that the file cuts only on the forward stroke. A handle on the file and gloves on the hands help prevent injuries.

Refer students to the suggested chapters in the recommended resource texts. They both contain more complete information that will be helpful to understanding this objective. Demonstrate jointing, sharpening, and honing of a variety of hand tools. Use TM: A3–4B to summarize the steps in sharpening hand tools. LS: A3–4A provides suggestions for applying the content of this objective.

Objective 3: Discuss the replacement of tool handles.

Anticipated Problem: How are tool handles replaced?

- III. Many tools have wooden handles. Improper use, age, and exposure to water and other substances cause handles to fail. Replacing a handle costs far less than buying a new tool of the same quality. The handles in hammers, saws, axes, and other tools can be easily replaced.
- A. The first step is to remove the damaged or broken handle. Clamp the tool in a vise and cut off the handle. Use a $\frac{1}{4}$ inch or $\frac{3}{8}$ inch metal cutting drill bit and drill numerous holes into the wooden core. Drive the remaining honeycomb of wood out of the head using a large punch or rod.
 - B. Purchase a quality handle of the correct size. The **eye of the tool head** is the hole where the handle is fitted. The hole is smaller on the side where the handle enters than on the opposite side. Once the handle is inserted, it can be wedged out to fill the larger portion of the hole. As long as the wedges stay in place, the head remains tight on the handle. The end of the handle that is shaped to go into the head should be slightly longer than the head is deep and should be the same shape as the head eye. It should be slightly larger than the smallest part of the eye.
 - C. Use a wood rasp or half-round wood file to shape and fit the handle. Try the head frequently as wood is removed to avoid removing too much wood. Use a hand saw to make a kerf across the longest center line of the handle about $\frac{2}{3}$ of the way down the depth of the eye. When the handle is driven on, it should come from the eye with the excess being cut off with a hacksaw.
 - D. Fasten the handle in place by driving in first a wooden wedge and then one or two metal wedges.
 - E. Place the tool, head down, into a metal or plastic container about the size of the head. Soak the head in boiled linseed oil for several days to seal the wood.
 - F. Rakes, hoes, and forks have a tang that is held in the handle with a nail or rivet or by friction between the wood and metal.
 - G. Shovels and spades have a split metal tube that is tightened around the handle for support. A rivet is installed through the metal and the handle to hold the handle in place.

Assign students to read the suggested chapters in either of the recommended resource texts. Gather together tools with broken handles. Remove broken handles and purchase new handles. Use TM: A3–4C to show the general procedure for replacing a handle. Use LS: A3–4B to guide the replacement of a tool handle.

Objective 4: Discuss the proper care and storage of tools.

Anticipated Problem: How should tools be cared for and stored?

- IV. A high-quality tool will last for years if used and maintained properly. If tools are not used wrongly or abused, they will be effective and long-lasting. Tools that are rusty, dirty, and greasy are dangerous because they slip out the hands more easily. Proper care and storage of tools protects your investment and results in less accidents.
 - A. Protect or restore leather parts by rubbing with saddle soap mixed with water. Stiff dry leather will regain its softness and flexibility. Neat's foot oil can also be used.
 - B. Wooden surfaces are protected from drying out by wiping with boiled linseed oil or rubbing with paste wax.
 - C. Metal surfaces can be cleaned of dirt by first tapping with a metal object and then scraped, wire brushed, or wire wheeled.
 - D. Removing a light coat of rust is done by wiping with solvent. Once rust pits start it is necessary to use a wire brush, wire wheel, steel wool, or emery cloth. Dry the tool and coat with a light oil.
 - E. Replace damaged handles as described in the previous section.
 - F. Store tools away from moisture and high humidity. Wipe metal surfaces clean and coat them with light oil. Sharpen any dull tools before storing them. Examine the cords on all power tools for breaks in the insulation and check the condition of the plug.

Have students read the suggested chapters in the recommended resource text. Use classroom discussion to identify major concepts. Use TM: A3–4D to talk about the supplies needed for cleaning and protecting tools. Clean the shop tools or tools brought from home.

Review/Summary. Review the importance of maintaining and sharpening tools. Talk about the equipment needed to sharpen tools (TM: A3–4A) and the procedure for sharpening (TM: A3–4B). Discuss procedures for replacing handles, reconditioning tools, and storing tools. Use the review questions at the end of the chapters in the recommended texts.

Application. Use LS: A3–4A to sharpen hand tools and LS: A3–4B to replace a tool handle.

Evaluation. Take the written test. Grade the sharpened hand tools and the hand tool handle replacements.

Answers to Sample Test:

Part One: Matching

1 = c, 2 = d, 3 = a, 4 = e, 5 = b, 6 = g, 7 = h, 8 = f

Part Two: Completion

1. Wood chisel, plane bit
2. Cold chisel, center punch
3. three-corner or triangular
4. round
5. flat
6. saddle soap or Neat's foot oil
7. boiled linseed oil, paste wax

Part Three: Short Answer

1. Jointing, grinding, honing.
2. Use a $\frac{1}{4}$ inch or $\frac{3}{8}$ inch metal cutting drill bit and drill numerous holes into the wooden core. Drive the remaining honeycomb of wood out of the head using a large punch or rod.
3. Solvent, wire brush, wire wheel, steel wool, and emery paper (4 of these 5).

Test

Lesson A3–4: Caring for and Reconditioning Construction Tools**Part One: Matching**

Instructions. Match the term with the correct response. Write the letter of the term by the definition.

- | | | |
|-------------------------|------------------------------|--------------------|
| a. dressing tool | d. honing stone or whetstone | g. re-conditioning |
| b. eye of the tool head | e. jointing | h. temper |
| c. honing oil | f. quenching | |

- _____ 1. Used to help make honing easier.
_____ 2. Used to put the final edge on a sharpened tool.
_____ 3. Used to remove particles from the grinding wheel and make it round.
_____ 4. Removing the nicks at the end of a chisel.
_____ 5. The hole that the handle fits into the hammer.
_____ 6. The process of restoring a tool.
_____ 7. The degree of hardness and strength of metal.
_____ 8. The process in manufacturing of quickly cooling metal to improve its useful qualities.

Part Two: Completion

Instructions. Provide the word or words to complete the following statements.

1. _____ and _____ are sharpened to a 25 to 30 degree angle.
2. _____ and _____ are sharpened to a 60 degree angle.
3. A handsaw is sharpened using a _____ or _____ file.
4. A chain saw is sharpened using a _____ file.
5. A shovel is sharpened using a _____ file.
6. Stiff leather is reconditioned and softened with _____ or _____.
7. Wooden handles are preserved with _____ or _____.

Part Three: Short Answer

Instructions. Provide information to answer the following questions.

1. What are the three steps in sharpening tools?
 2. Describe how to remove a broken handle from a tool?
 3. Give four things that could be used to remove rust from tools:

TOOL SHARPENING EQUIPMENT

- I. Grinder**
- 2. Dressing tool**
- 3. Honing stone**
- 4. Honing oil**
- 5. Files**
 - A. Triangular**
 - B. Round**
 - C. Flat**

STEPS IN SHARPENING HAND TOOLS

I. JOINTING

**... removing the nicks and
rounded corners**

2. GRINDING

**... re-establishing the cutting
angle and cutting edge**

3. HONING

**...Removing the wire edge and
putting on the final edge**

GENERAL PROCEDURES FOR REPLACING TOOL HANDLES

- 1. Remove the broken handle.**
- 2. Purchase the correct size handle.**
- 3. Fit the handle to tool head.**
- 4. Insert the handle and cut off the excess.**
- 5. Drive in the wooden and steel wedges.**
- 6. Soak the head in boiled linseed oil.**

TOOL CLEANING AND PROTECTION SUPPLIES

I. Soften stiff leather parts

- a. Saddle soap**
- b. Neat's foot oil**

2. Preserve wooden handles

- a. Boiled linseed oil**
- b. Paste wax**

3. Rust removal

- a. Solvent**
- b. Wire brush**
- c. Wire wheel**
- d. Steel wool**
- e. Emery cloth**
- f. Light oil**

Lab Sheet

Sharpening Hand Tools

Directions: Use the steps summarized in TM: A3–4B to sharpen the hand tools listed below.

- _____ 1. Sharpen a wood chisel
- _____ 2. Sharpen plane bit
- _____ 3. Sharpen a cold chisel
- _____ 4. Recondition a standard screwdriver blade
- _____ 5. Sharpen a hoe, spade, or shovel

Lab Sheet

Replacing Tool Handles

- _____ 1. Remove the broken handle. Cut off the broken handle. Use a $\frac{1}{4}$ inch or $\frac{3}{8}$ inch metal cutting drill bit and drill numerous holes into the wooden core. Drive the remaining honeycomb of wood out of the head using a large punch or rod.
- _____ 2. Purchase a quality tool handle of the correct size.
- _____ 3. Use a wood rasp or half-round wood file to shape and fit the handle. Try the head frequently as wood is removed to avoid removing too much wood. Work the handle down until the head slides on snugly. It should come to rest about $\frac{1}{2}$ inch from the enlarged part of the handle. Mark the handle on both sides of the head and remove the head
- _____ 4. Use the handsaw to cut a kerf $\frac{2}{3}$ of the depth of the hole in the tool eye. Reposition the handle in the vise and squeeze the end until the saw kerf is completely closed. Run the saw down through the kerf again. When released, the kerf will be wider at the end than further down in the handle.
- _____ 5. Re-insert the handle into the head and drive it in securely with a wooden mallet. Use a hacksaw to cut off the excess of the handle sticking through the head.
- _____ 6. Drive in a wooden wedge so the handle spreads and fills the head. Use a hacksaw to saw off the excess wooden wedge.
- _____ 7. Drive one or two metal wedges in at right angles to the wooden wedge.
- _____ 8. Place the tool, head down, into a metal or plastic container about the size of the head. Add boiled linseed oil and brush oil around the handle and the head. Allow it to soak for several days to seal the wood
- _____ 9. Remove the tool, rub oil on all parts of the handle, dry, and polish.