OBJECTIVES

After studying Chapter 4, the reader will be able to:

- Describe what tool is the best to use for each job.
- Discuss how to safely use hand tools.
- Explain the difference between the brand name (trade name) and the proper name for tools.
- Explain how to maintain hand tools.

WRENCHES

- **Wrenches** are the most used hand tool by service technicians.
- Most wrenches are constructed of forged alloy steel, usually chrome-vanadium steel.

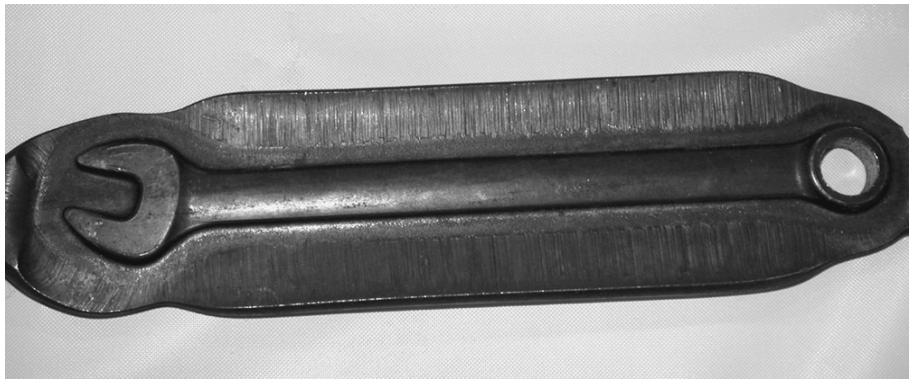

FIGURE 4-1 A forged wrench after it has been forged but before the flashing; extra material around the wrench has been removed.

WRENCHES
Open-End Wrench

- An **open-end wrench** is usually used to loosen or tighten bolts or nuts that do not require a lot of torque.
- An open-end wrench has two different sizes; one at each end.

FIGURE 4-2 A typical open-end wrench.The size is different on each end.Notice that the head is angled 15 degrees at each end.

WRENCHES
Box-End Wrench

- A **box-end wrench** is placed over the top of the fastener and grips the points of the fastener.
- A box-end wrench is angled 15 degrees to allow it to clear nearby objects.

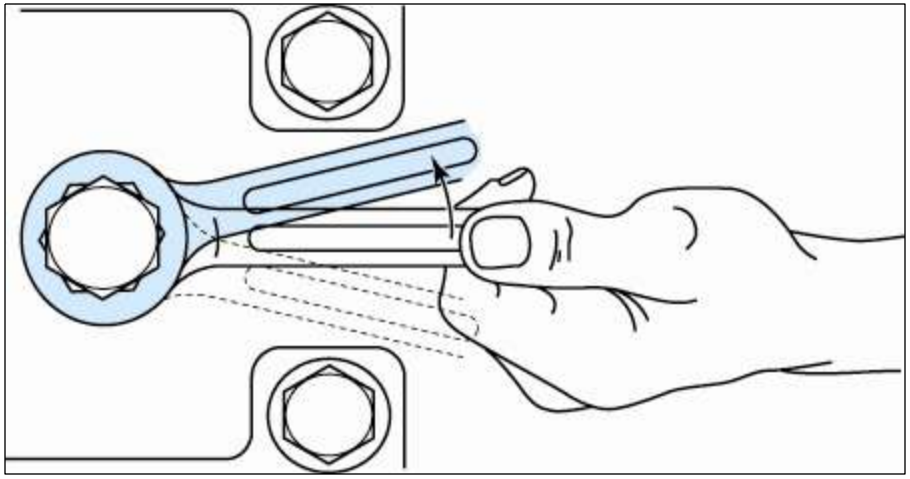

FIGURE 4-3 A typical box-end wrench is able to grip the bolt or nut at points completely around the fastener. Each end is a different size.

WRENCHES
Box-End Wrench

- A box-end wrench has two different sizes; one at each end.

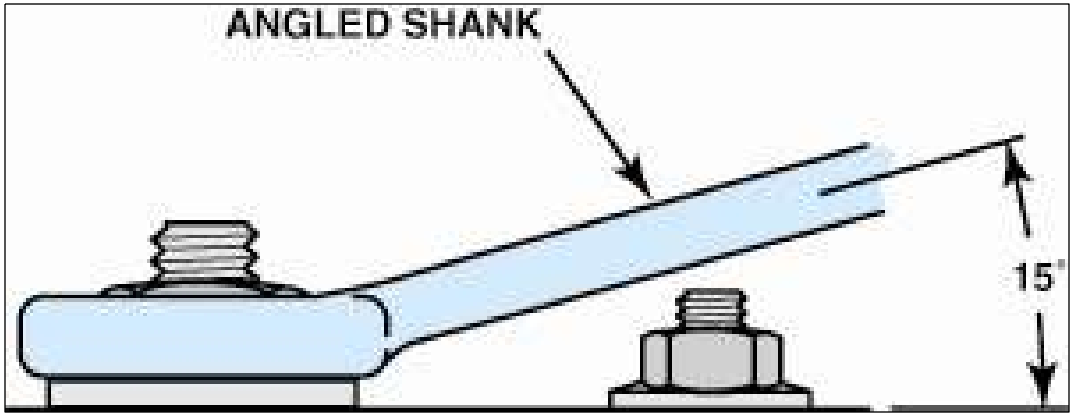

FIGURE 4-4 The end of a box-end wrench is angled 15 degrees to allow clearance for nearby objects or other fasteners.

WRENCHES
Box-End Wrench

- Most service technicians purchase **combination wrenches,** which have the open end at one end and the same size box end on the other end.

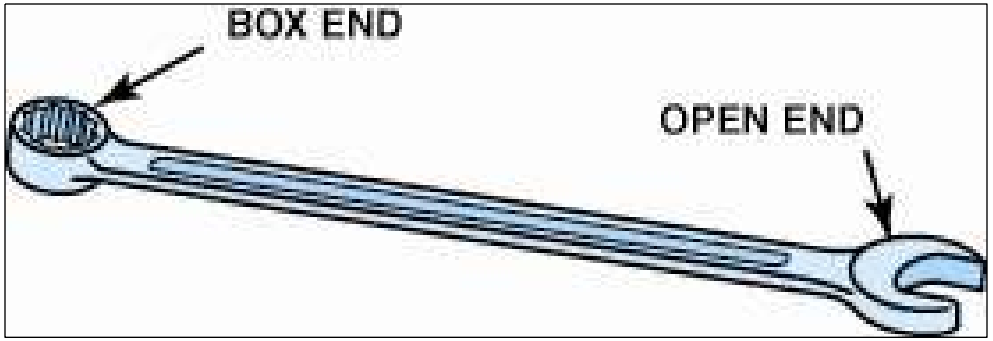

FIGURE 4-5 A combination wrench has an open end at one end and a box end at the other end.

WRENCHES
Adjustable Wrench

- An **adjustable wrench** is often used where the exact size wrench is not available or when a large nut, such as a wheel spindle nut, needs to be rotated but not tightened.

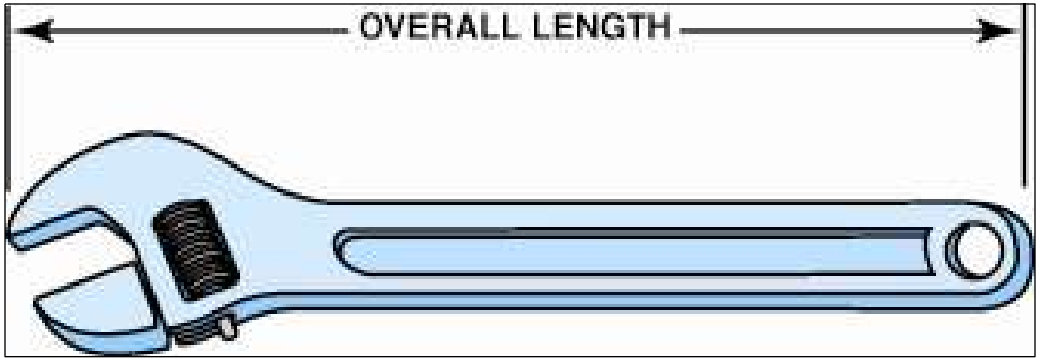

FIGURE 4-6 An adjustable wrench. Adjustable wrenches are sized by the overall length of the wrench and not by how far the jaws open. Common sizes of adjustable wrenches include 8, 10, and 12 inch.

WRENCHES

Line Wrenches

- Line wrenches are also called **flare-nut wrenches, fitting wrenches,** or **tube-nut wrenches** and are designed to grip almost all the way around a nut used to retain a fuel or refrigerant line, and yet, be able to be installed over the line.

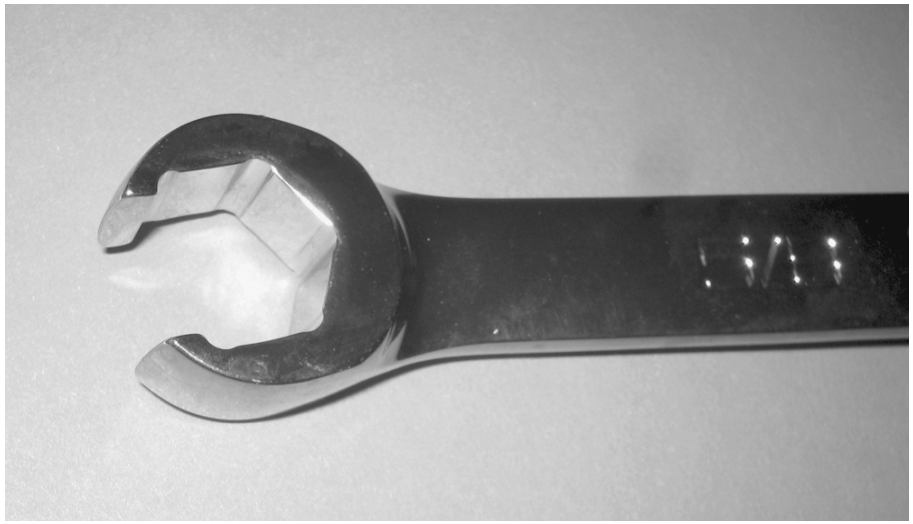

FIGURE 4-7 The end of a typical line wrench, which shows that it is capable of grasping most of the head of the fitting.

RATCHETS, SOCKETS, AND EXTENSIONS

- A **socket** fits over the fastener and grips the points and/or flats of the bolt or nut.
- The socket is rotated (driven) using either a long bar called a **breaker bar (flex handle)** or a **ratchet.**

RATCHETS, SOCKETS, AND EXTENSIONS

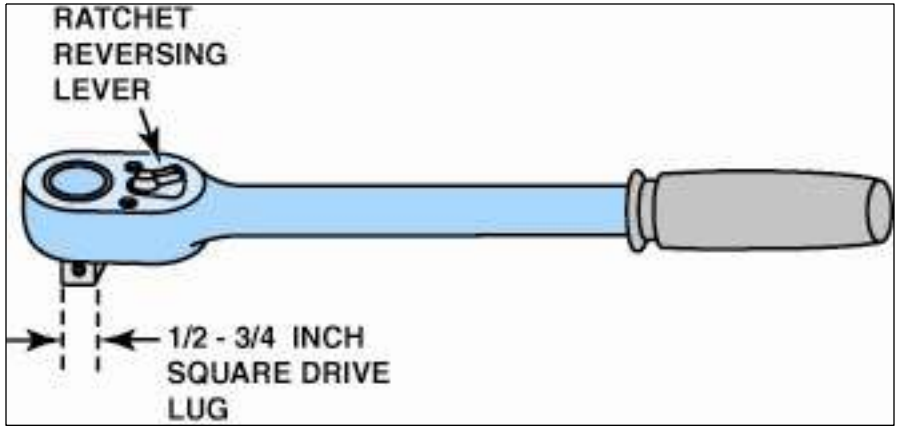

FIGURE 4-8 A typical ratchet used to rotate a socket. A ratchet makes a ratcheting noise when it is being rotated in the opposite direction from loosening or tightening. A knob or lever on the ratchet allows the user to switch directions.

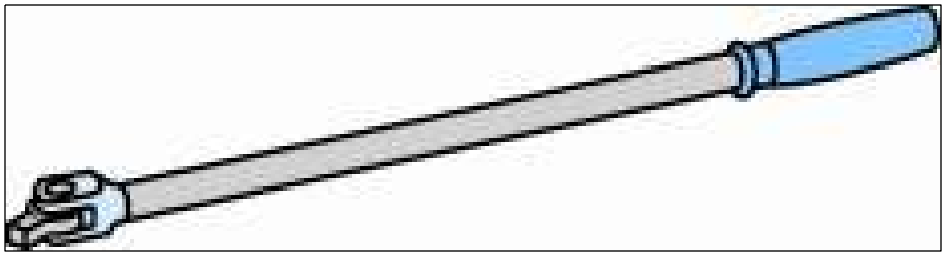

FIGURE 4-9 A typical flex handle used to rotate a socket, also called a breaker bar because it usually has a longer handle than a ratchet and, therefore, can be used to apply more torque to a fastener than a ratchet.

RATCHETS, SOCKETS, AND EXTENSIONS

- Sockets are available in various **drive sizes,** including 1/4-inch, 3/8-inch, and 1/2-inch sizes for most automotive use.

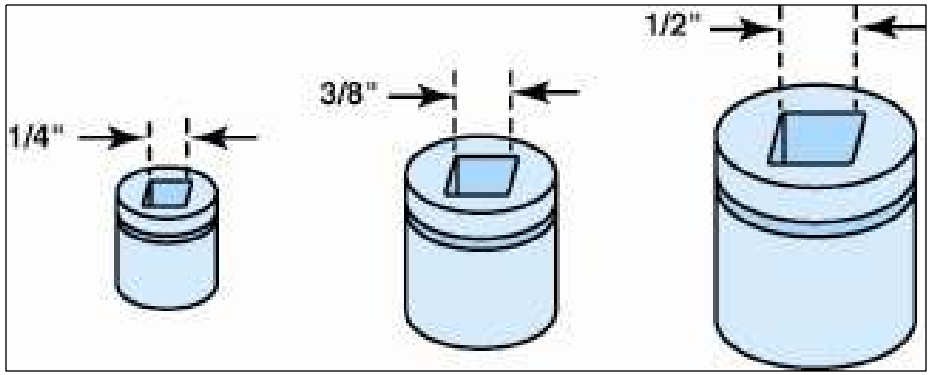

FIGURE 4-10 The most commonly used socket drive sizes include 1/4-inch, 3/8-inch, and 1/2-inch drive.

RATCHETS, SOCKETS, AND EXTENSIONS

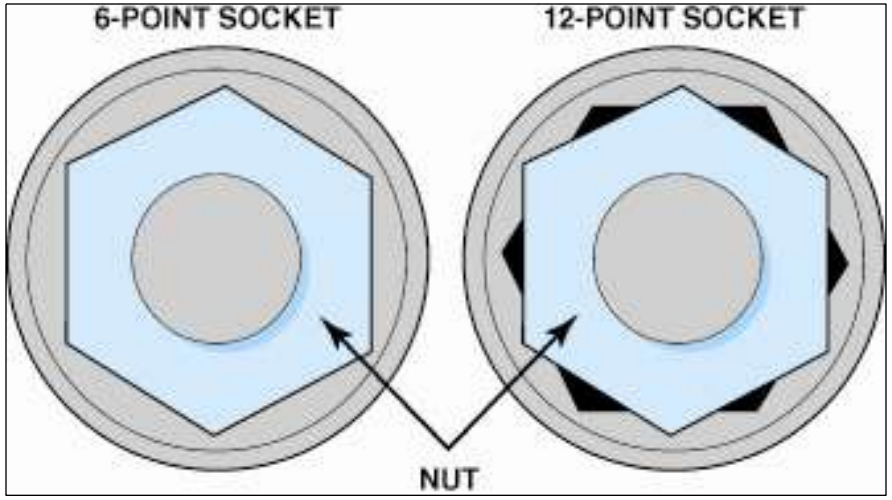

FIGURE 4-11 A 6-point socket fits the head of the bolt or nut on all sides. A 12-point socket can round off the head of a bolt or nut if a lot of force is applied.

RATCHETS, SOCKETS, AND EXTENSIONS
Crowfoot Sockets

- A **crowfoot socket** is a socket that is an open-end or line wrench to allow access to fasteners that cannot be reached using a conventional wrench.

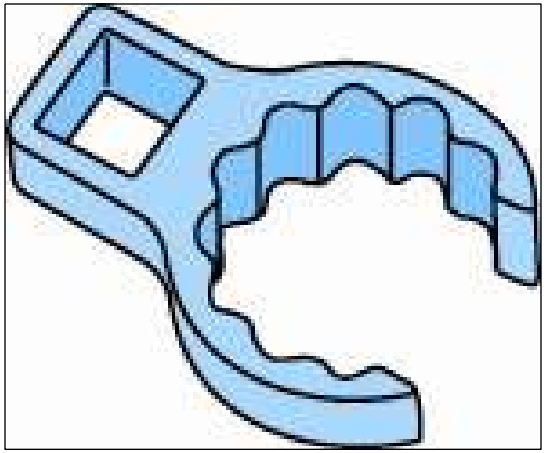

FIGURE 4-12 A crowfoot socket is designed to reach fasteners using a ratchet or breaker bar with an extension.

RATCHETS, SOCKETS, AND EXTENSIONS
Torque Wrenches

- **Torque wrenches** are socket turning handles that are designed to apply a known amount of force to the fastener.
- There are two basic types of torque wrenches including:
  - Clicker Type
  - Beam Type

RATCHETS, SOCKETS, AND EXTENSIONS
Torque Wrenches

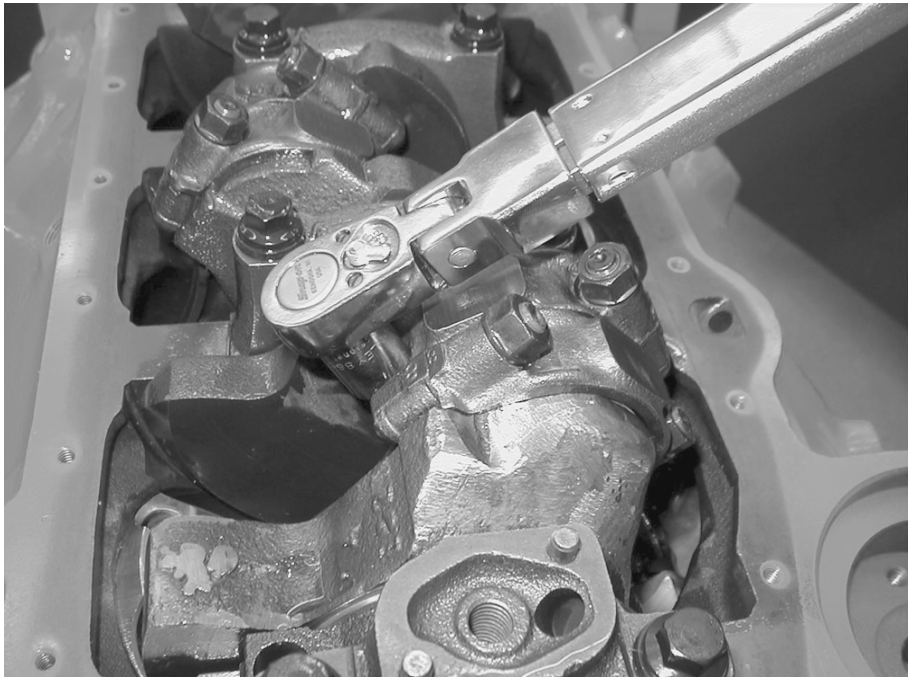

FIGURE 4-13 Using a torque wrench to tighten connecting rod nuts on an engine.

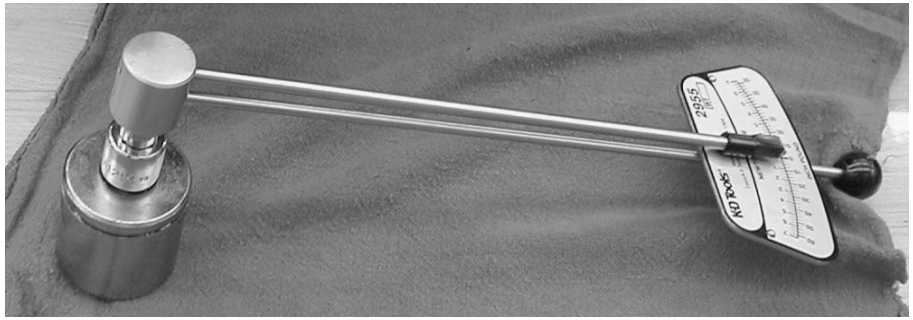

FIGURE 4-14 A beam-type torque wrench that displays the torque reading on the face of the dial. The beam display is read as the beam defects, which is in proportion to the amount of torque applied to the fastener.

CHECK TORQUE WRENCH CALIBRATION REGULARLY

- Most experts recommend that torque wrenches be checked and adjusted as needed at least every year and more often if possible.

FIGURE 4-15 Torque wrench calibration checker.

RATCHETS, SOCKETS, AND EXTENSIONS
Safe Use of Sockets and Ratchets

- Always use the proper size socket that correctly fits the bolt or nut.
- All sockets and ratchets should be cleaned after use before being placed back into the toolbox.

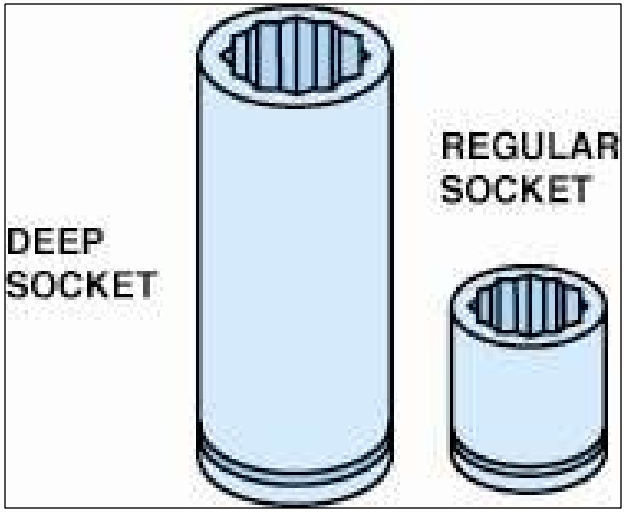

FIGURE 4-16 Deep sockets allow access to the nut that has a stud plus other locations needing great depth, such as spark plugs.

SCREWDRIVERS

- Many smaller fasteners are removed and installed by using a **screwdriver.**
  - The most commonly used screwdriver is called a **flat tip** or **straight blade.**

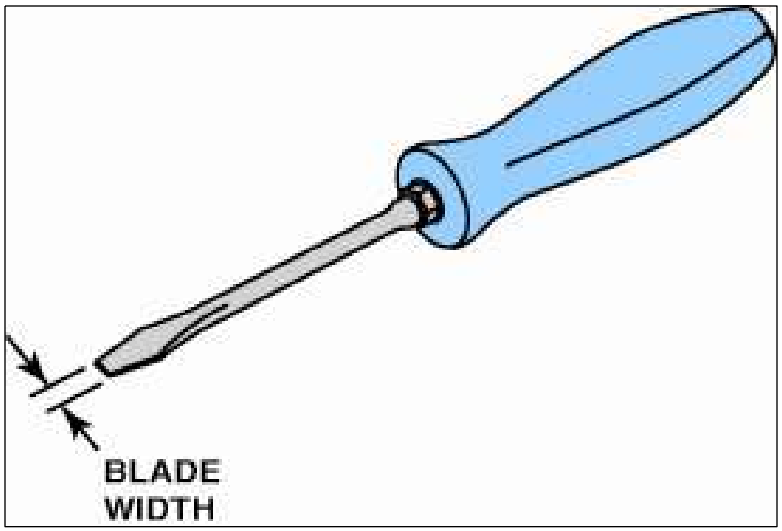

FIGURE 4-17 A flat-tip (straight blade) screwdriver. The width of the blade should match the width of the slot in the fastener being loosened or tightened.

SCREWDRIVERS

- Both straight blade and Phillips screwdrivers are available with a short blade and handle for access to fasteners with limited room.

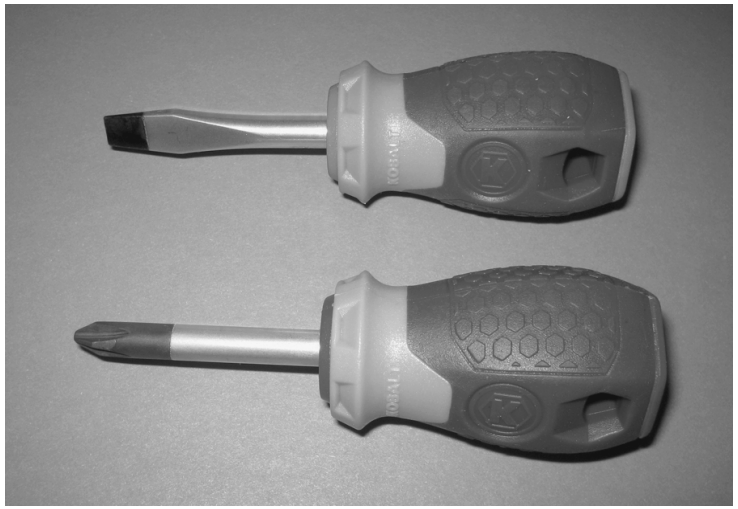

FIGURE 4-18 Two stubby screwdrivers that are used to access screws that have limited space above. A straight blade is on top and a #2 Phillips screwdriver is on the bottom.

SCREWDRIVERS
Offset Screwdrivers

- An offset screwdriver is bent at the ends and is used similar to a wrench.

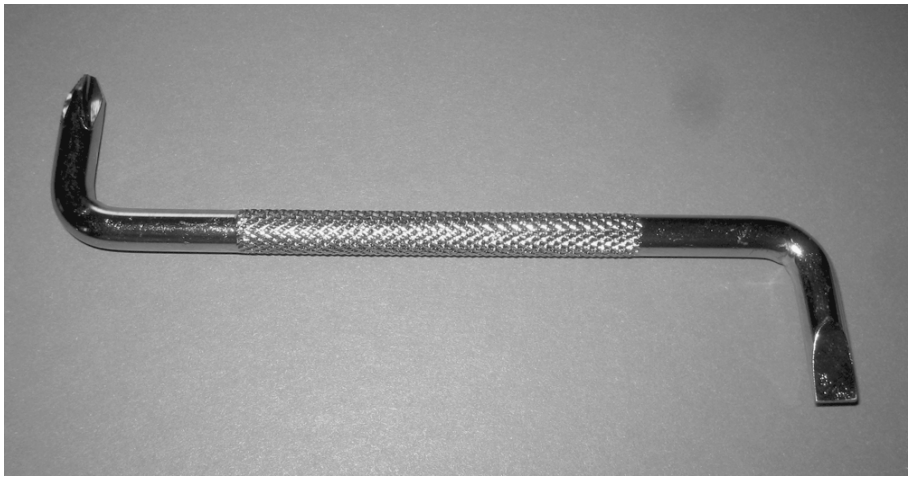

FIGURE 4-19 An offset screwdriver is used to install or remove fasteners that do not have enough space above to use a conventional screwdriver.

SCREWDRIVERS
Impact Screwdriver

- An impact screwdriver is used to break loose or tighten a screw.
- A hammer is used to strike the end after the screwdriver holder is placed in the head of the screw and rotated in the desired direction.

FIGURE 4-20 An impact screwdriver used to remove slotted or Phillips head fasteners that cannot be broken loose using a standard screwdriver.

HAMMERS AND MALLETS

- Hammers and mallets are used to force objects together or apart.
  - The shape of the back part of the hammer head (called the **peen**) usually determines the name.

FIGURE 4-21 A typical ball-peen hammer.

HAMMERS AND MALLETS

Mallets

- Mallets are a type of hammer with a large striking surface, which allows the technician to exert force over a larger area than a hammer, so as not to harm the part or component.

FIGURE 4-22 A rubber mallet used to deliver a force to an object without harming the surface.

HAMMERS AND MALLETS
Mallets

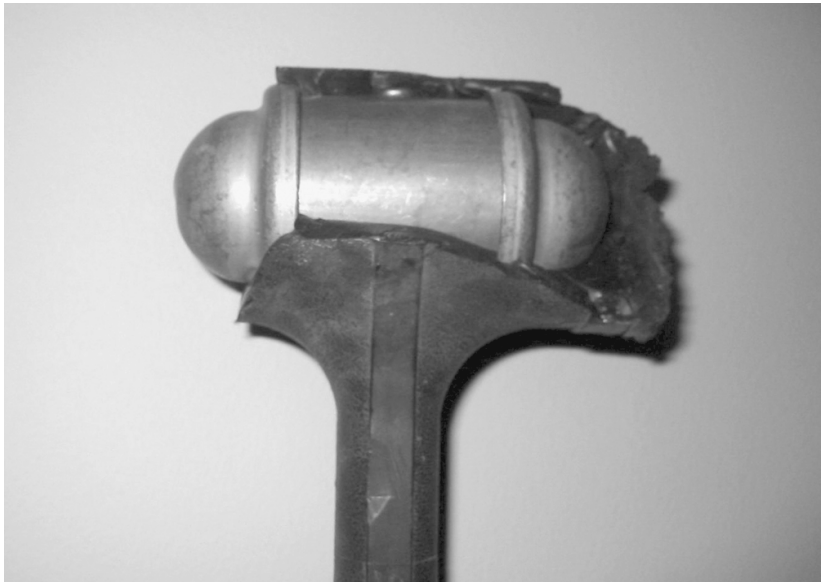

FIGURE 4-23 A dead-blow hammer that was left outside in freezing weather. The plastic covering was damaged, which destroyed this hammer. The lead shot is encased in the metal housing and then covered.

PLIERS
Slip-Joint Pliers

- Pliers are capable of holding, twisting, bending, and cutting objects and are an extremely useful classification of tools.

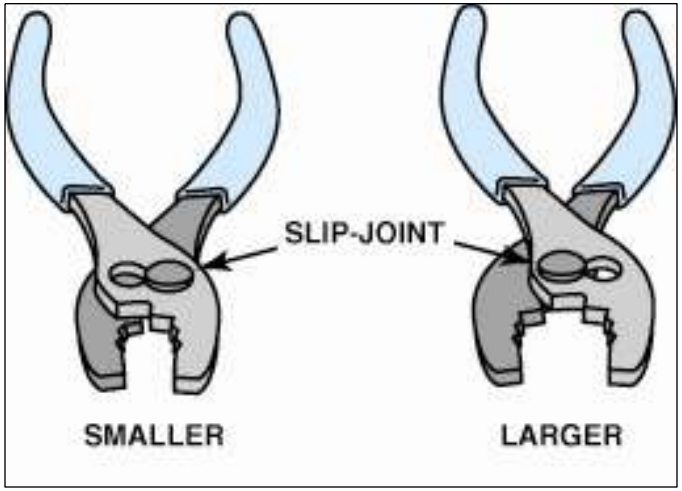

FIGURE 4-24 Typical slip-joint pliers, which are also common household pliers. The slip joint allows the jaws to be opened to two different settings.

PLIERS
Multigroove Adjustable Pliers

- For gripping larger objects, a set of **multigroove adjustable pliers** is a commonly used tool of choice by many service technicians.

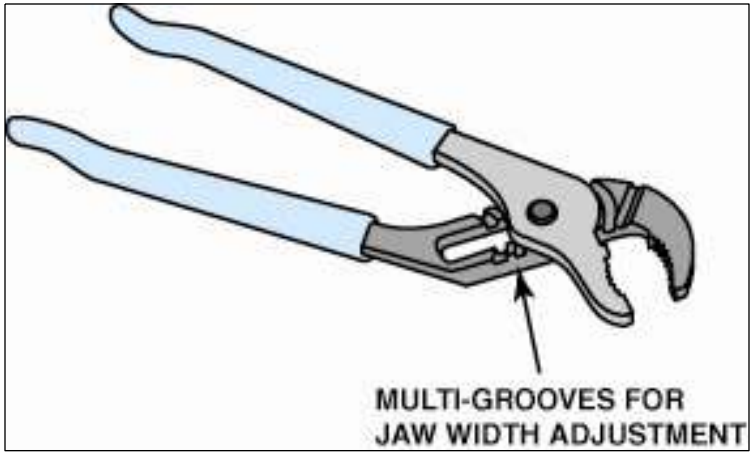

FIGURE 4-25 Multigroove adjustable pliers are known by many names, including the trade name “Channel Locks.”

PLIERS
Linesman's Pliers

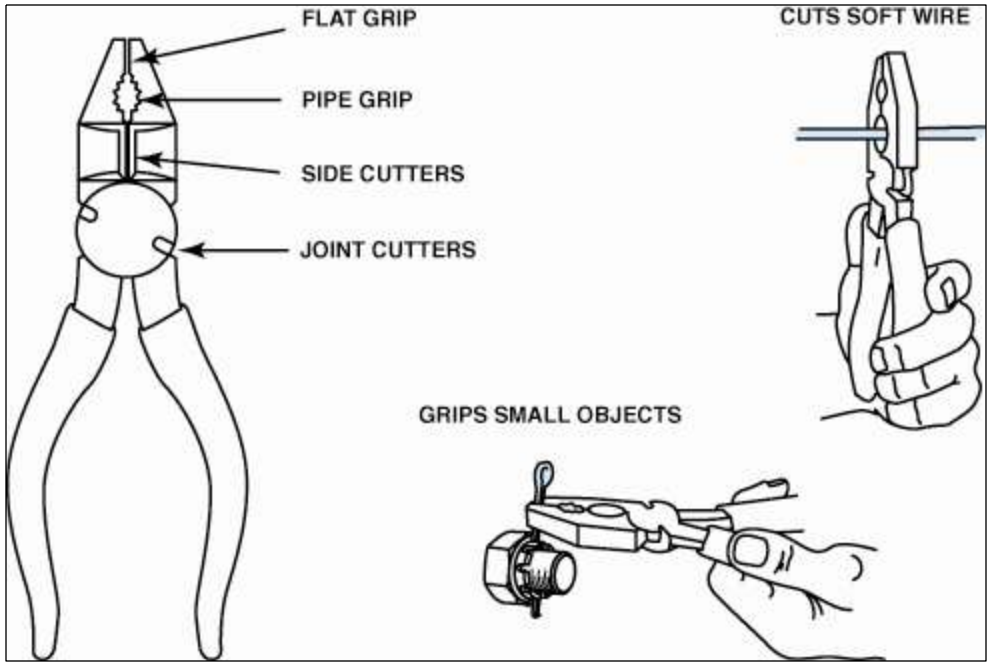

FIGURE 4-26 A linesman's pliers are very useful because they can help perform many automotive service jobs.

PLIERS
Diagonal Pliers

- **Diagonal pliers** are designed for cutting only.
- The cutting jaws are set at an angle to make it easier to cut wires.

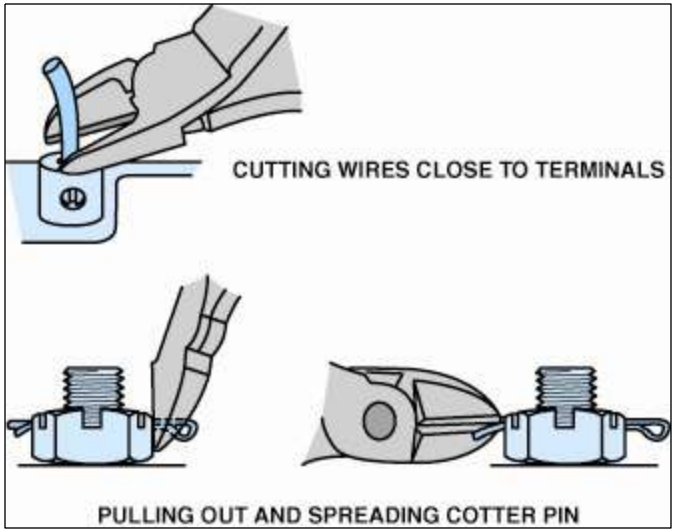

FIGURE 4-27 Diagonal-cut pliers are another common tool that has many names.

PLIERS
Needle-Nose Pliers

- **Needle-nose pliers** are designed to grip small objects or objects in tight locations.
- Needle-nose pliers have long, pointed jaws, which allow the tips to reach into narrow openings or groups of small objects.

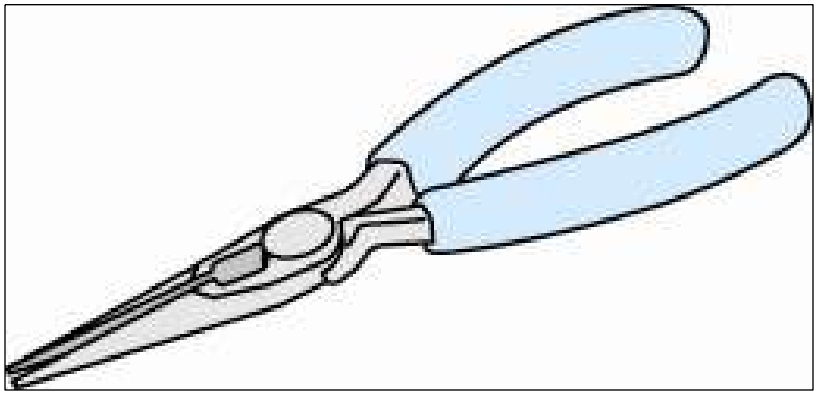

FIGURE 4-28 Needle-nose pliers are used where there is limited access to a wire or pin that needs to be installed or removed.

PLIERS
Locking Pliers

- **Locking pliers** are adjustable pliers that can be locked to hold objects from moving.

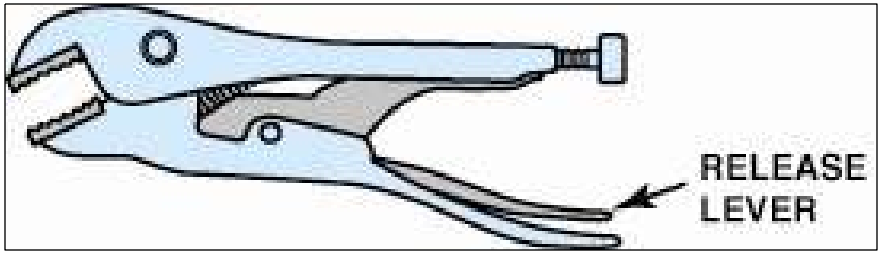

FIGURE 4-29 Locking pliers are best known by their trade name Vise Grips®.

PLIERS

Snap-Ring Pliers

- **Snap-ring pliers** are used to remove and install snap rings.

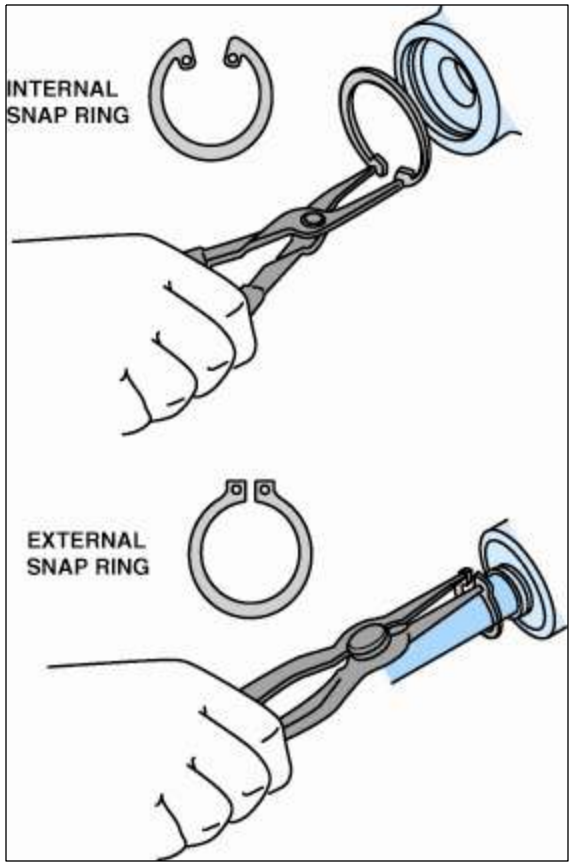

FIGURE 4-30 Snap-ring pliers are also called lock-ring pliers and are designed to remove internal and external snap rings (lock rings).

PLIERS
Files

- **Files** are used to smooth metal and are constructed of hardened steel with diagonal rows of teeth.

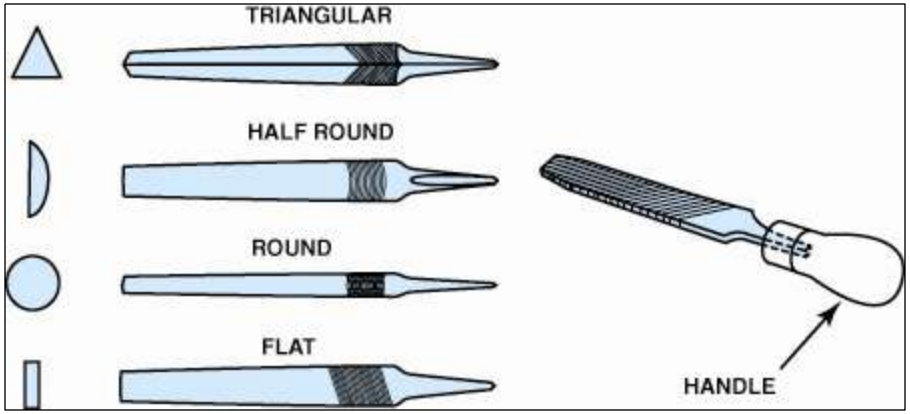

FIGURE 4-31 Files come in many different shapes and sizes. Never use a file without a handle.

CUTTERS

Snips

- Service technicians are often asked to fabricate sheet metal brackets or heat shields and need to use one or more types of cutters available.
- The simplest is called **tin snips,** which are designed to make straight cuts in a variety of materials, such as sheet steel, aluminum, or even fabric.

CUTTERS
Snips

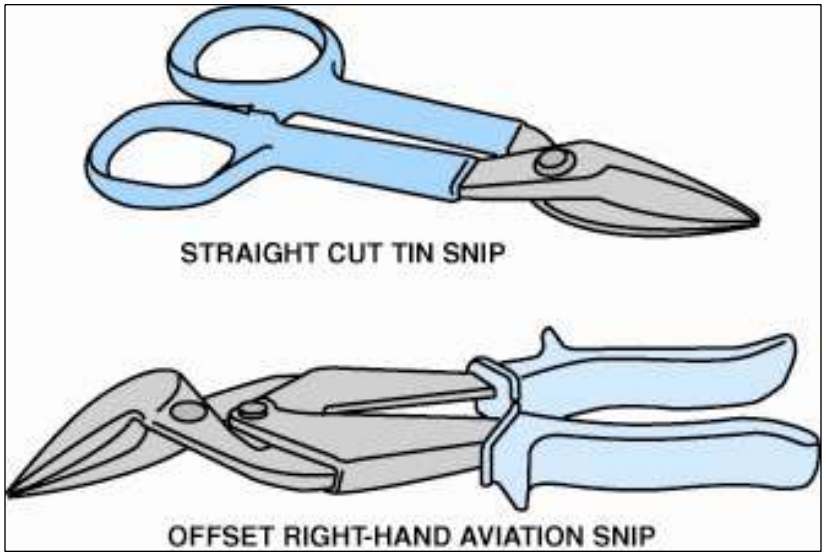

FIGURE 4-32 Tin snips are used to cut thin sheets of metal or carpet.

CUTTERS
Utility Knife

- A **utility knife** uses a replaceable blade and is used to cut a variety of materials such as carpet, plastic, wood, and paper products, such as cardboard.

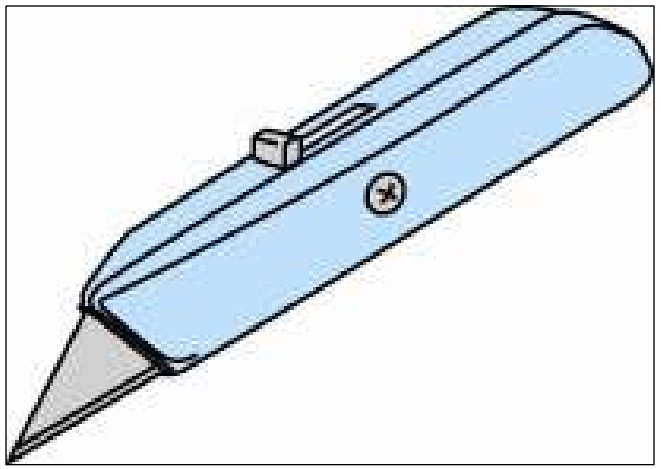

FIGURE 4-33 A utility knife uses replaceable blades and is used to cut carpet and other materials.

PUNCHES AND CHISELS

Punches

- A **punch** is a small diameter steel rod that has a smaller diameter ground at one end.
- A punch is used to drive a pin out that is used to retain two components.

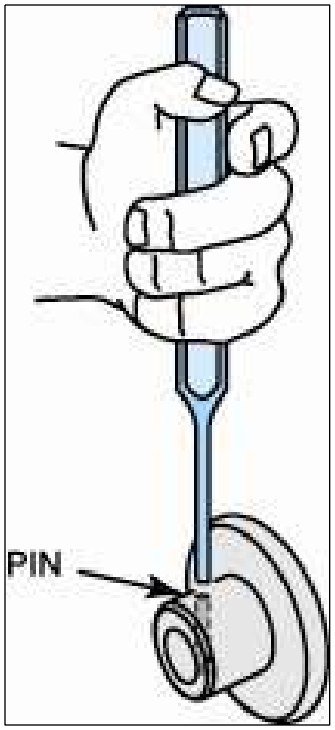

FIGURE 4-34 A punch used to drive pins from assembled components. This type of punch is also called a pin punch.

PUNCHES AND CHISELS

Chisels

- A **chisel** has a straight, sharp cutting end that is used for cutting off rivets or to separate two pieces of an assembly.

FIGURE 4-35 Warning stamped in the side of a punch warning that goggles should be worn when using this tool. Always follow safety warnings.

PUNCHES AND CHISELS
Chisels

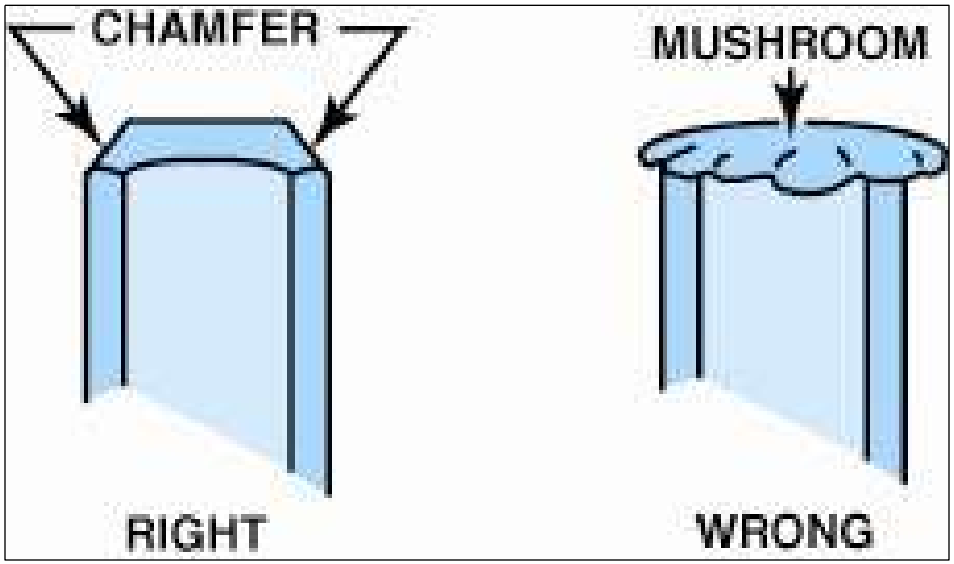

FIGURE 4-36 Use a grinder or a file to remove the mushroom material on the end of a punch or chisel.

REMOVERS

- **Removers** are tools used to remove damaged fasteners.

REMOVERS
Damaged Heads

- If the bolt head or a nut becomes damaged or rounded, there are two special tools that can be used, including:
  - Stud remover
  - Nut splitter

REMOVERS
Damaged Heads

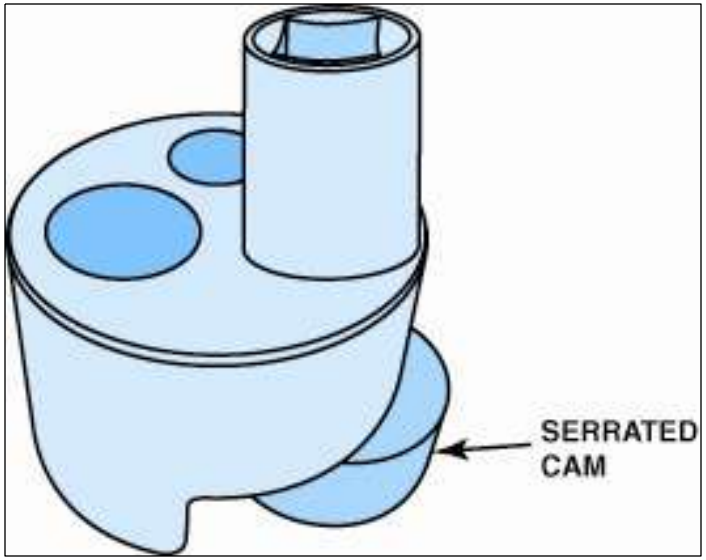

FIGURE 4-37 A stud remover uses an offset serrated wheel to grasp the stud so it will be rotated when a ratchet or breaker bar is used to rotate the assembly.

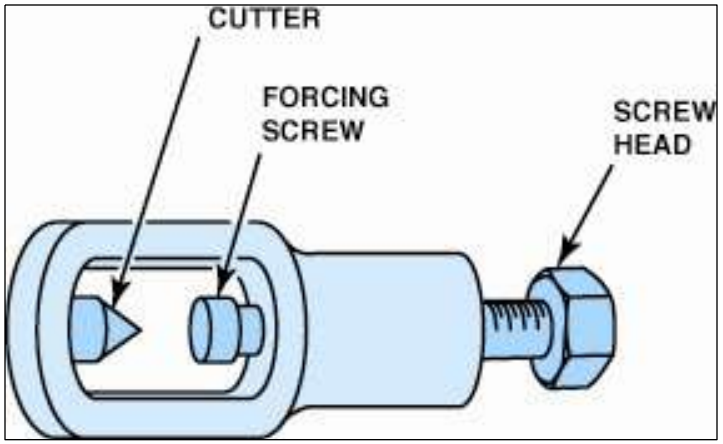

FIGURE 4-38 A nut splitter is used to split a nut that cannot be removed. After the nut has been split, a chisel is then used to remove the nut.

REMOVERS
Broken Bolts, Studs, or Screws

- Often, bolts, studs, or screws break even with, or below, the surface, making stud removal tools impossible to use.
- Bolt extractors are commonly called **"easy outs."**

FIGURE 4-39 A set of bolt extractors, commonly called easy outs.

THE WAX TRICK

- Many technicians heat the fastener using a torch and then apply paraffin wax or a candle to the heated fastener.

FIGURE 4-40 Removing plugs or bolts is easier if the plug is first heated to cherry red color, using a torch, and then applying wax. During cooling, the wax flows in between the threads, making it easier to remove.

HACKSAWS

- A **hacksaw** is used to cut metals, such as steel, aluminum, brass, or copper.
- The cutting blade of a hacksaw is replaceable and the sharpness and number of teeth can be varied to meet the needs of the job.

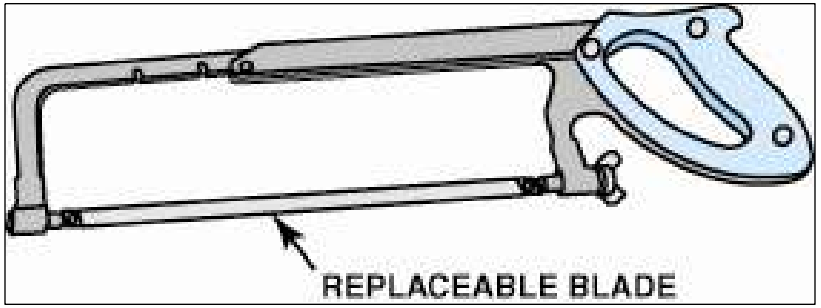

FIGURE 4-41 A typical hacksaw that is used to cut metal. If cutting sheet metal or thin objects, a blade with more teeth should be used.

TOOL SETS AND ACCESSORIES

- A beginning service technician may wish to start with a small set of tools before spending a lot of money on an expensive, extensive tool box.

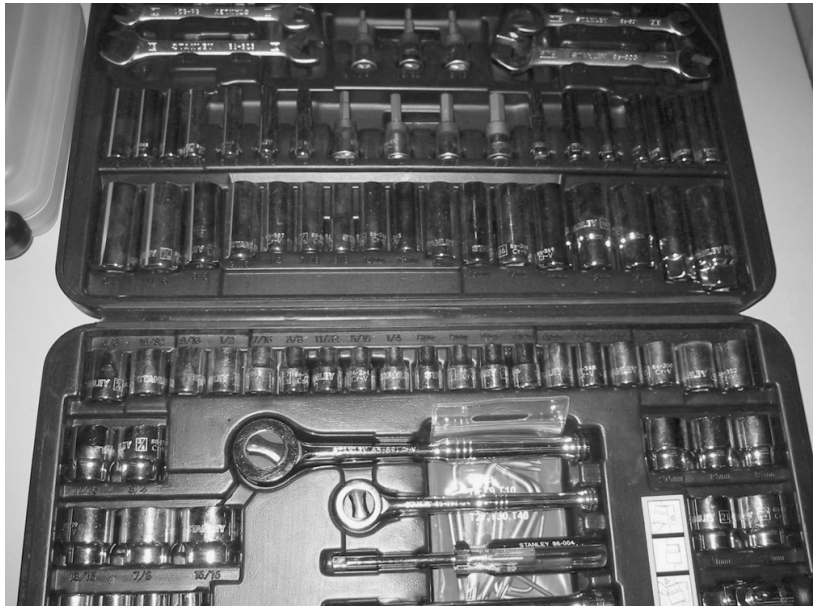

FIGURE 4-42 A typical beginning technician tool set that includes the basic tools to get started.

TOOL SETS AND ACCESSORIES

FIGURE 4-43 A typical large tool box, showing just one of many drawers.

SEAL DRIVERS AND PULLERS

Seal Pullers

- Grease seals are located on many automotive components, including brake rotors, transmission housings, and differentials.
- A **seal puller** is used to properly remove grease seals.

SEAL DRIVERS AND PULLERS

Seal Pullers

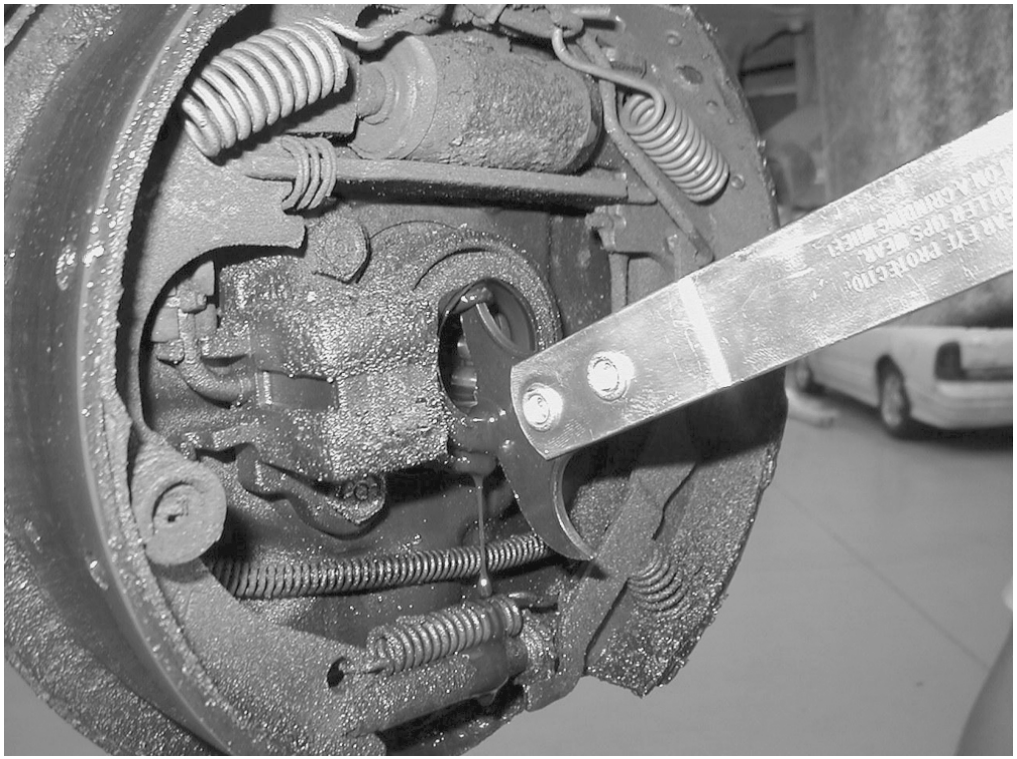

FIGURE 4-44 A seal puller being used to remove a seal from a rear axle.

SEAL DRIVERS AND PULLERS

Seal Drivers

- A **seal driver** can be either plastic or metal, usually aluminum, and is used to seat the outer lip of a grease seal into the grease seal pocket.

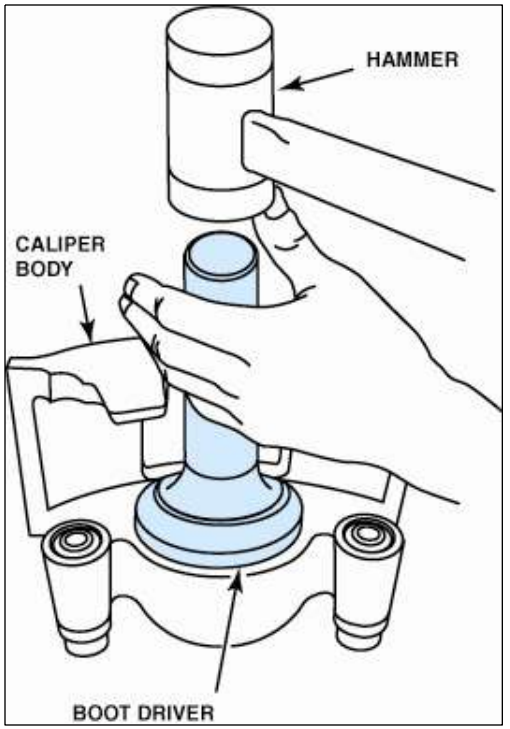

FIGURE 4-45 A seal driver or installer is usually plastic and is designed to seat the seal.

ELECTRICAL HAND TOOLS

Test Lights

- A test light is used to test for electricity.
  - A typical automotive test light consists of a clear plastic screwdriver-like handle that contains a light bulb.

FIGURE 4-46 A typical 12-volt test light.

ELECTRICAL HAND TOOLS

Soldering Guns

- Electric soldering gun
- Electric soldering pencil
- Butane-powered soldering iron

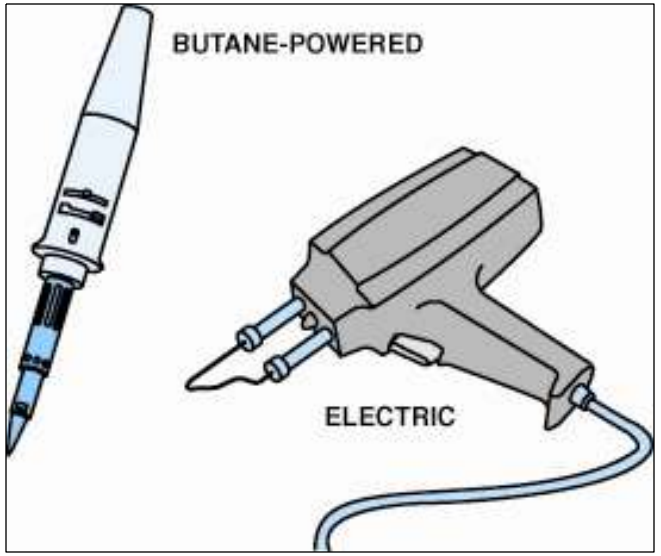

FIGURE 4-47 An electric soldering gun used to make electrical repairs. Soldering guns are sold by the wattage rating. The higher the wattage, the greater amount of heat created. Most solder guns used for automotive electrical work usually fall within the 60- to 160-watt range.

USE A BINDER CLIP

- A binder clip (size 1 1/4 inches wide) is used by wise technicians to help keep fender covers in place.

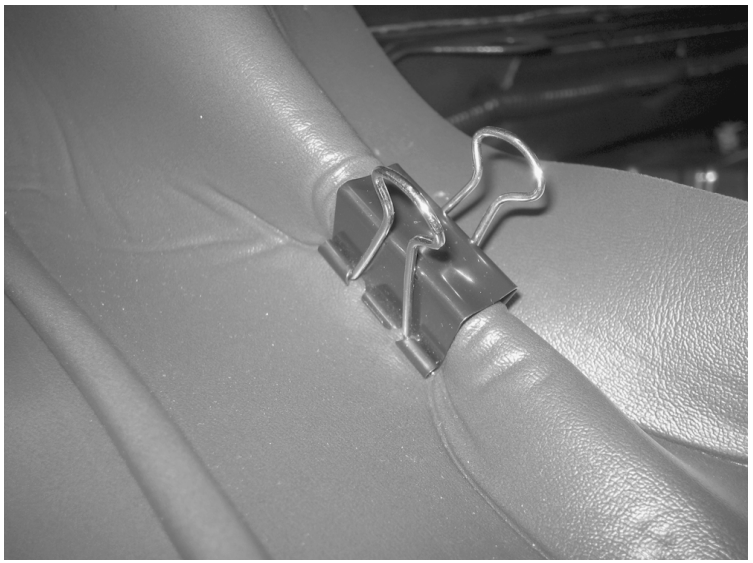

FIGURE 4-48 A binder clip being used to keep a fender cover from falling.

HAND TOOL MAINTENANCE

- Most hand tools are constructed of rust-resistant metals but they can still rust or corrode if not properly maintained.
- For best results and long tool life, the following steps should be taken:
  - Clean each tool before placing it back into the tool box.
  - Keep tools separated.
  - Line the drawers of the tool box with a material that will prevent the tools from moving as the drawers are opened and closed.
  - Release the tension on all “clicker-type” torque wrenches.
  - Keep the tool box secure.

SUMMARY

- Wrenches are available in open end, box end, and combination open and box end.
- An adjustable wrench should only be used where the proper size is not available.
- Line wrenches are also called flare-nut wrenches, fitting wrenches, or tube-nut wrenches and are used to remove fuel or refrigerant lines.
- Sockets are rotated by a ratchet or breaker bar, also called a flex handle.
- Torque wrenches measure the amount of torque applied to a fastener.

SUMMARY

- Screwdriver types include straight blade (flat tip) and Phillips.
- Hammers and mallets come in a variety of sizes and weights.
- Pliers are a useful tool and are available in many different types, including slip-joint, multigroove, linesman's, diagonal, needle-nose, and locking pliers.
- Other common hand tools include snap-ring pliers, files, cutters, punches, chisels, and hacksaws.

REVIEW QUESTIONS

- Why are wrenches offset 15 degrees?
- What are the other names for a line wrench?
- What are the standard automotive drive sizes for sockets?
- Which type of screwdriver requires the use of a hammer or mallet?
- What is inside a dead-blow hammer?
- What type of cutter is available in left and right cutters?

CHAPTER QUIZ

- When working with hand tools, always _____.
  - Push the wrench—don't pull toward you
  - Pull a wrench—don't push a wrench

CHAPTER QUIZ

2. The proper term for Channel Locks is _____.
   - Vise Grips
   - Crescent wrench
   - Locking pliers
   - Multigroove adjustable pliers

CHAPTER QUIZ

3. The proper term for Vise Grips is _____.
   - Locking pliers
   - Slip-joint pliers
   - Side cuts
   - Multigroove adjustable pliers

CHAPTER QUIZ

4. Which tool listed is a brand name?
    - Locking pliers
    - Monkey wrench
    - Side cutters
    - Vise Grips

CHAPTER QUIZ

5. Two technicians are discussing torque wrenches. Technician A says that a torque wrench is capable of tightening a fastener with more torque than a conventional breaker bar or ratchet. Technician B says that a torque wrench should be calibrated regularly for the most accurate results. Which technician is correct?
   - Technician A only
   - Technician B only
   - Both Technicians A and B
   - Neither Technician A nor B

CHAPTER QUIZ

6. What type of screwdriver should be used if there is very limited space above the head of the fastener?
   - Offset screwdriver
   - Stubby screwdriver
   - Impact screwdriver
   - Robertson screwdriver

CHAPTER QUIZ

7. Where is the “peen” of the hammer?
   - The striking face
   - The handle
   - The back part opposite the striking face
   - The part that connects to the handle

CHAPTER QUIZ

8. What type of hammer is plastic coated, has a metal casing inside, and is filled with small lead balls?
   - Dead-blow hammer
   - Soft-blow hammer
   - Sledge hammer
   - Plastic hammer

CHAPTER QUIZ

9. Which type of pliers is capable of fitting over a large object?
   - Slip-joint pliers
   - Linesman's pliers
   - Locking pliers
   - Multigroove adjustable pliers

CHAPTER QUIZ

10. Which tool has a replaceable cutting edge?
    - Side-cut pliers
    - Tin snips
    - Utility knife
    - Aviation snips

END