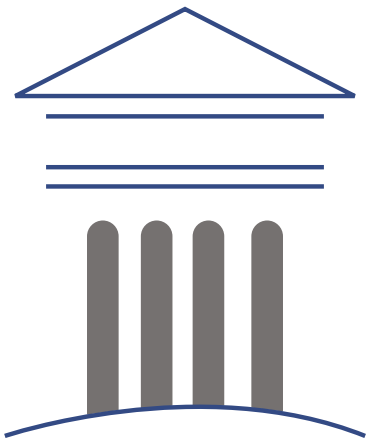
Basic Hand Tools Lab (#)
Lab: 2490

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Introduction

A gunsmith, like any other craftsman, relies on certain tools to help with specialized types of work. Without the proper tools, a task will be accomplished at the expense of time and quality. Having the proper tools is essential for producing quality work.

In this training kit, we will discuss some of the tools used by gunsmiths, how to use them, and how to take care of them. Also, we will talk about some of the fasteners you will find on firearms.

Screwdrivers, punches, and hammers are used by a gunsmith on a daily basis. You are probably acquainted with these types of tools. However, the screwdrivers that a gunsmith uses are not ordinary screwdrivers, and the punches and hammers that you have around the house are not suited to all the needs of a gunsmith.

Kit Contents

The tools you received are shown in Figure 1. The part numbers and descriptions appear next to the figure.

Check the material that you received against the parts list to make sure that your kit is complete. If any part is obviously defective or has been damaged during shipment, please return it to the Sonoran Desert Institute for replacement. Also, notify the Sonoran Desert Institute if any part is missing from your kit.



***Figure 1**: The tools included in your kit.*

** Please note that from time-to-time kits may be unavailable. Should this occur, we will substitute an appropriate kit that will meet the objective of this lesson.*

Screwdrivers

A gunsmith uses a screwdriver more frequently than other tools, to drive or turn screws with slotted heads. The common screwdriver, shown in Figure 2, is used for slotted-head screws. This type of screwdriver works fine for most screws. However, a gunsmith uses a hollow-ground screwdriver, shown in Figure 3. As you can see, the tip of the blade is ground parallel at the end. This allows the tip to completely fill the slot of the screw. This applies more torque (turning force) to the screw, and prevents the screwdriver from slipping out of the slot and damaging the screw head. Always select the proper size screwdriver for the job. The tip should fit snugly in the screw slot as shown in Figure 4. A screwdriver that is too large or too small is hard to use and may damage the screw, firearm, and/or the screwdriver. Also, never use a screwdriver as a pry bar, punch, or chisel. You will damage the tip or break the shaft.

Always keep the tip ground as shown in Figure 3. The blade of the screwdriver is made of tempered steel.

This means that it has been heat-treated for hardness. If it gets too hot when you are grinding the tip, you will "pull" the temper out of the steel or soften it. Keep a glass of water near the grinder. Dip the screwdriver tip in the water every few seconds as you grind it to keep the steel from overheating.

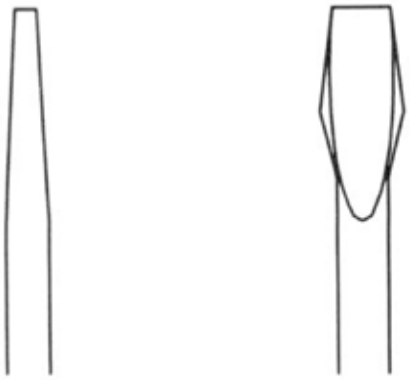


***Figure 2**: Common screwdriver.*

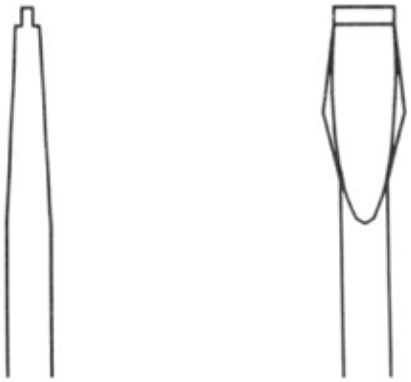


***Figure 3**: A hollow-ground screwdriver.*

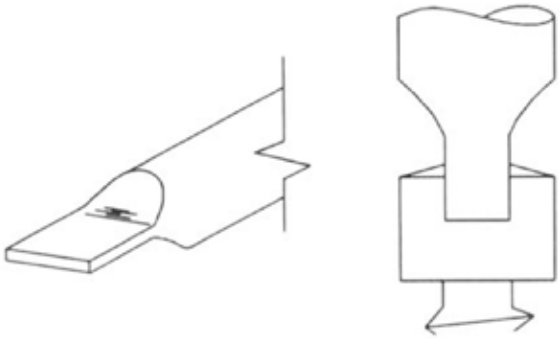


***Figure 4**: The proper fit of a hollow-ground screwdriver.*

Hammers

Figure 5 shows several different types of hammers. The brass (D) and the ball-peen (A) are the two most widely used by gunsmiths. Any hammer should be gripped at the end of the handle, and the face should strike the object squarely, as shown in Figure 6 on the next page.

When you are striking an object that is hard, such as a steel center punch, you should use a ball-peen hammer. If the object is soft, such as a brass punch, or can be easily damaged, use a brass hammer.

Always check the hammerhead and handle of any hammer for tightness before use. A wedge or screw in the head end of the handle keeps the head from coming loose. If the head should fly off, it could easily injure someone.

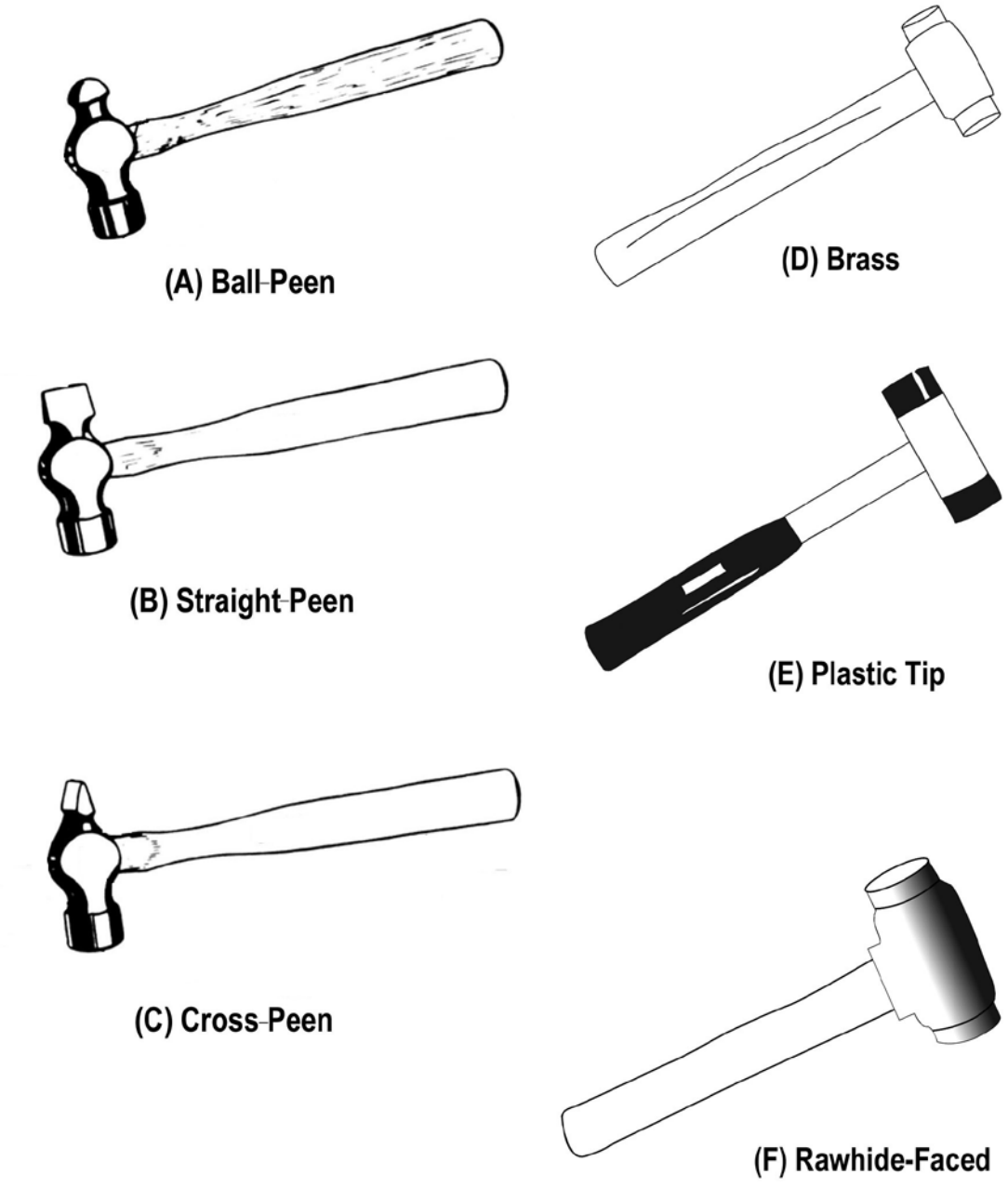


***Figure 5**: Six different types of hammers.*

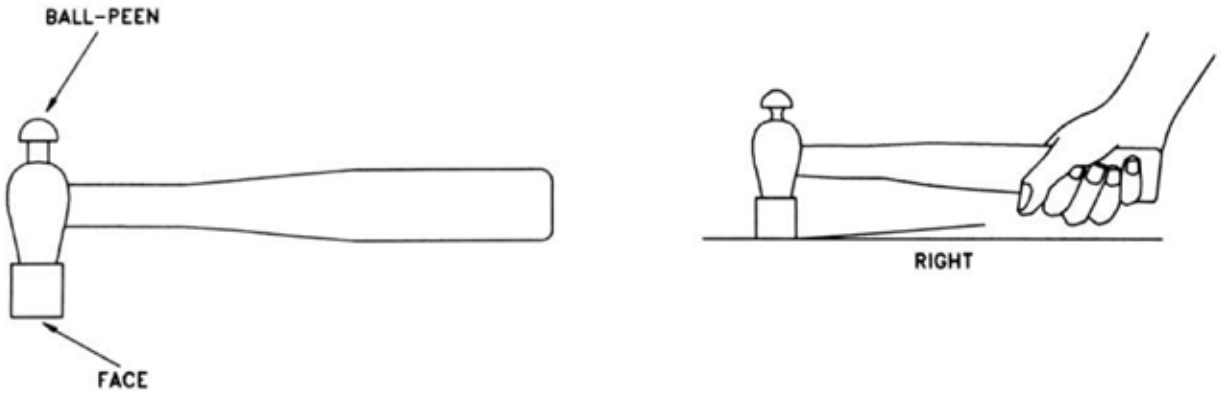


Figure 6: *It's important to grip a hammer properly.*



Close up of screwdrivers included in your kit.

Punches

Figure 7 shows the three types of punches used by a gunsmith. The *drift* and the *pin punch* are usually used together. The drift punch can be considered a starter punch. Because of the taper of the drift punch, it is not suitable to remove pins, as shown in Figure 8. The pin can be started with a drift punch, and then tapped out with a pin punch.

The *brass punches* that you received can also be used to move the sights of some handguns with fixed sights. Since the brass of the punch is softer than the steel of the firearm, you will not damage the sight or surface to which it is mounted. However, you will have to be careful not to mar the finish.

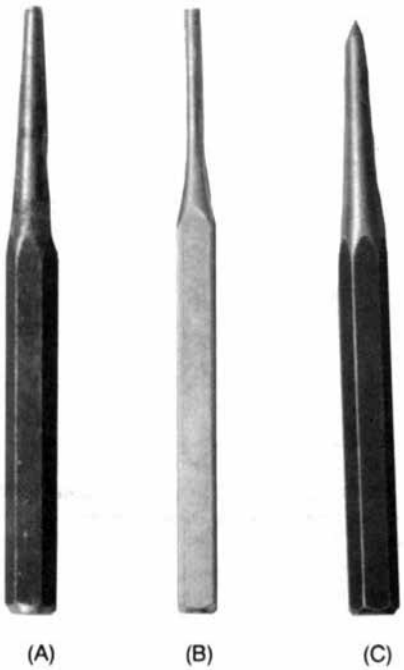


***Figure 7**: Three types of punches: (A) drift), (B) pin, (C) center.*

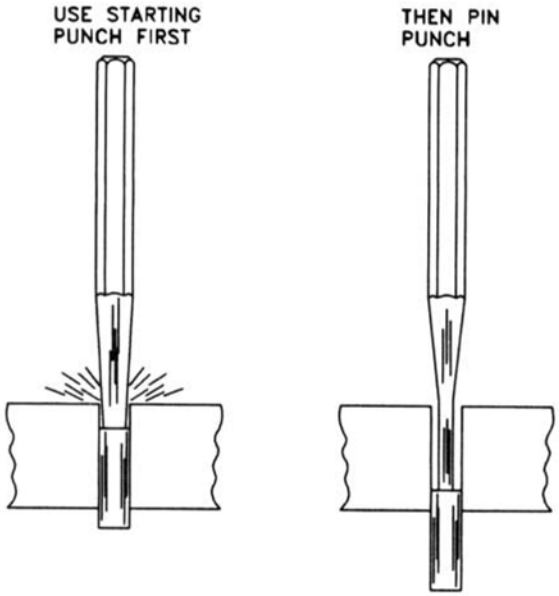


***Figure 8**: Using drift or starting, and pin punches.*

Most handguns that have fixed sights will have a dovetail cut in the slide or frame, like the one shown in Figure 9. The sight is then pressed into this groove. This sight can be moved in either direction by placing the correct size punch against the sight and tapping the punch with a hammer. Use only light taps and check for accuracy often. A small movement of the sights will cause a surprisingly noticeable change in the point of bullet impact.



***Figure 9**: A dovetail cut in the slide for the front sight in a sig sauer P226*

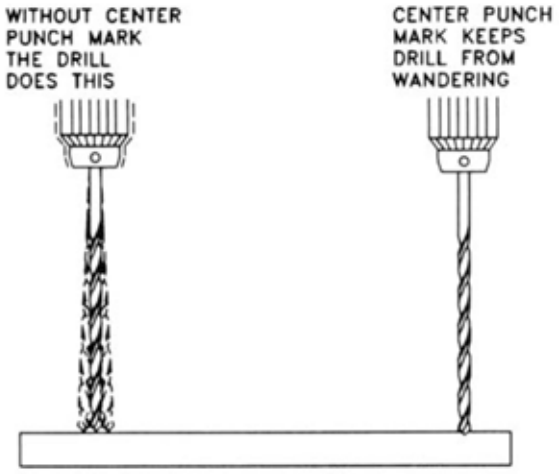


***Figure 10**: Center-punching a hole location will prevent drill from "walking".*

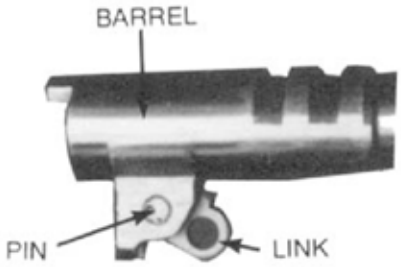


***Figure 11**: A staked link pin.*

When selecting a punch, choose one that is close to the size of the pin to be removed. If the punch is too small, and the pin binds, the punch will be bent or broken. Also, you will need less force to remove the pin if the punch is the correct size.

Use a center punch to mark the location of a hole before drilling. This helps to keep the drill from wandering, or moving around on the surface of the piece to be drilled, as shown in Figure 10. This is particularly true if the piece is curved, like a rifle barrel. If the hole location is first center-punched, the drill will grab and not "walk."

Another use of the center punch is "staking" a pin. This is a method of holding a pin in place. First, slide the pin into its proper location; then, make a dimple in the end of the pin with a center punch while supporting the opposite end of the pin on a hard surface. This dimple forces the metal at the end of the pin to expand, making the end of the pin a larger diameter but not affecting the center of the pin. Figure 11 shows a staked link pin for a Colt 1911 .45. The pin is staked in place on the barrel but the link can freely move on the pin.

A staked pin is removed the same as an unstaked pin. It takes more force to drive the pin out from the side, which is not staked. Do not reuse a pin that has been staked; always use a new pin.

Finally, a gunsmith can use a center punch to raise metal on a surface. This procedure is called peening. A center punch is held against the surface to be peened, and tapped with a hammer. This causes a dent to form on the surface. However, the sides of the dent are raised above the surface as shown in Figure 12. This procedure can be used to tighten the headspace of a break-action shotgun.

Punches, particularly soft brass punches, will require dressing from time to time, because both ends of the punch begin to flare out from the impact of the hammer and pins. This flare should be carefully removed with a file or grinder. The end of the punch that is struck with the hammer is not critical and can be slightly squared. However, the point of the punch should be kept round and parallel with the shaft. To accomplish this, keep the punch rotating as the grinder or file removes the flare.

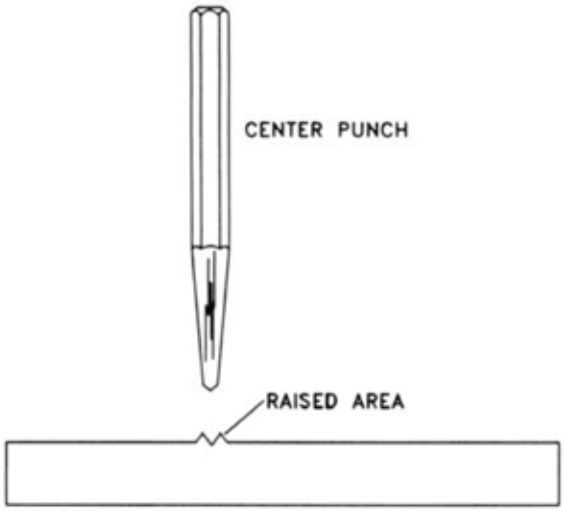


***Figure 12**: A center punch will not only make a depression, but will also cause the edges to rise from the surface.*

Cutting Tools

FILES

A file is a type of cutting tool, with a flat surface on which there are many cutting edges, or teeth. There are dozens of file types, and many types of cut available with each type. The parts of a file are shown in Figure 13. The term cut refers to the cuts that have been made across the face of the file to form the file teeth. The terms indicating coarseness or fineness are, in order: *rough, coarse, bastard, second-cut, smooth-cut,* and *dead-smooth*. Figure 14 illustrates four of these. When the cuts are relatively far apart, the file is called a *rough,* or *coarse-cut*, file. When the cuts are close together the file is called a *smooth*, or *dead-smooth*, file. The coarser the file the more metal it removes with each stroke and the rougher it leaves the surface that is filed.

When only one series of cuts has been made across the face of the file, with all the cuts parallel to one another, the file is now as a *single-cut* file, regardless of its coarseness. When the file has two series of cuts across the face in two different directions, as shown in Figure 15, it is known as a *double-cut* file. Double-cutting a file produces a large number of small teeth, with each tooth acting like the point of a chisel.

In addition to the classifications above, files are classified according to their shape. Files may be *flat, triangular, square, half-round,* or *round (rat-tail)*, with or without taper from heel to tip. Many special types of files are also available. Selecting the cut and shape of the file to be used depends upon the work to be done. A few types of files are shown in Figure 16.

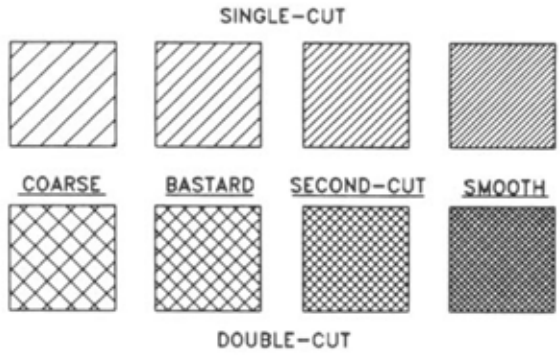


***Figure 14**: Various file cuts.*

Put a handle on a file before you use it. Otherwise, you may accidentally drive the pointed tang into your hand. Handles are made in various sizes for various sizes of files. To install the handle, place the tang of the file in the hole of the handle and tap the butt end of the handle on the bench, as shown in Figure 17 on page 12. Never hammer on the file to drive it into place. The file is brittle and may shatter.

Be sure to hold the part to be filed securely. Clamp it in a vise, if possible, and use a soft vise jaw to protect the part from scarring.

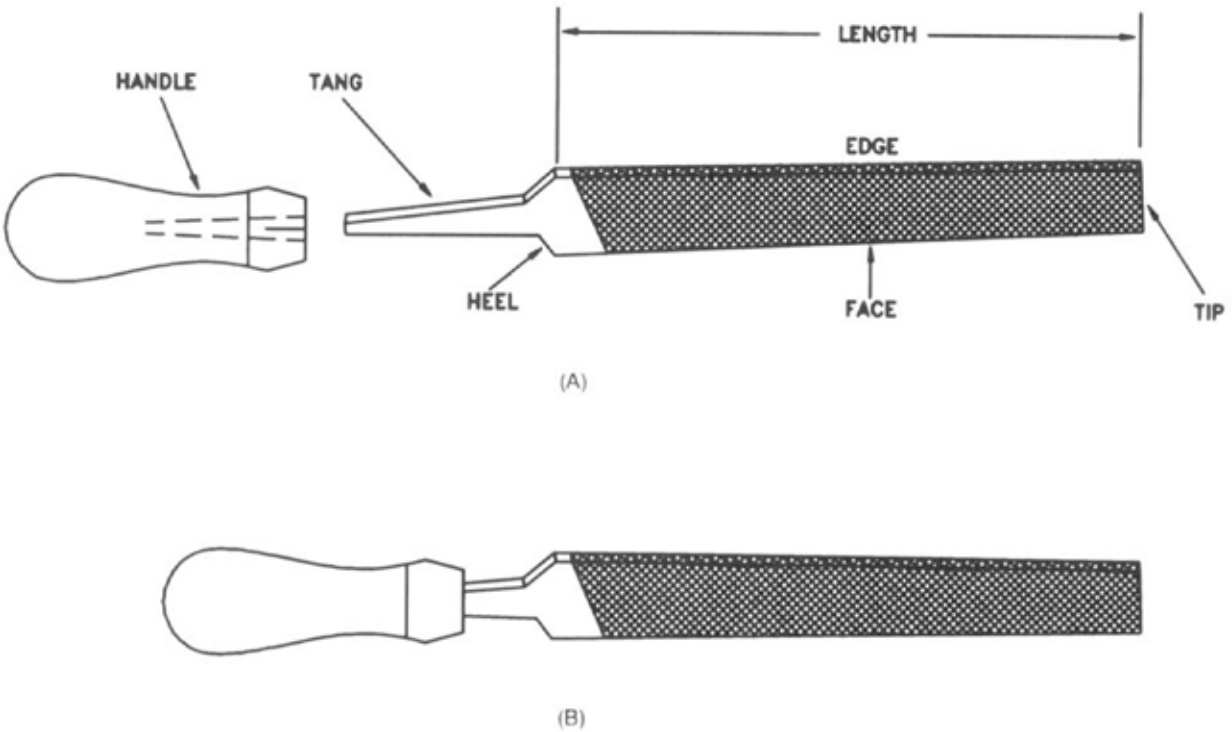


***Figure 13**: A file (A) open with its parts identified, and (B) closed with the handle covering the tang.*

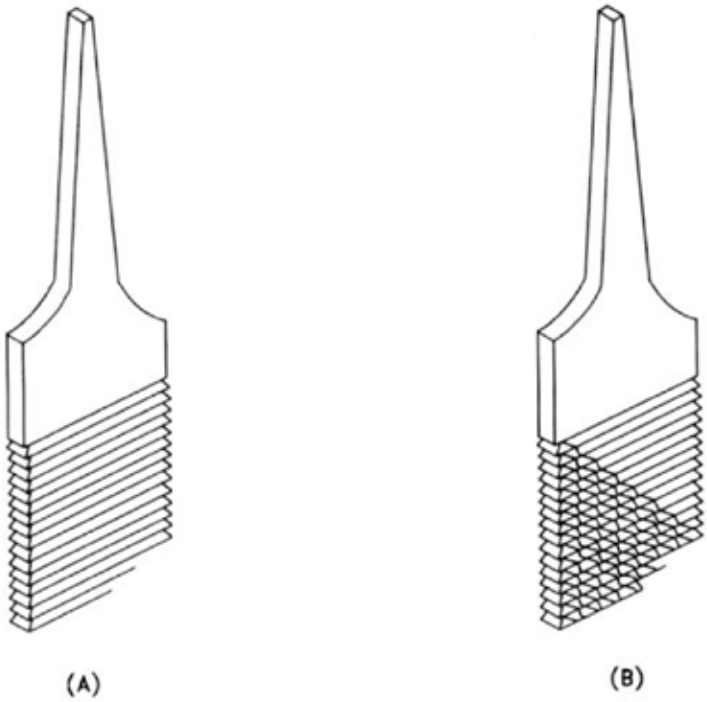


***Figure 15**: Files are either (A) single-cut, or (B) double-cut*

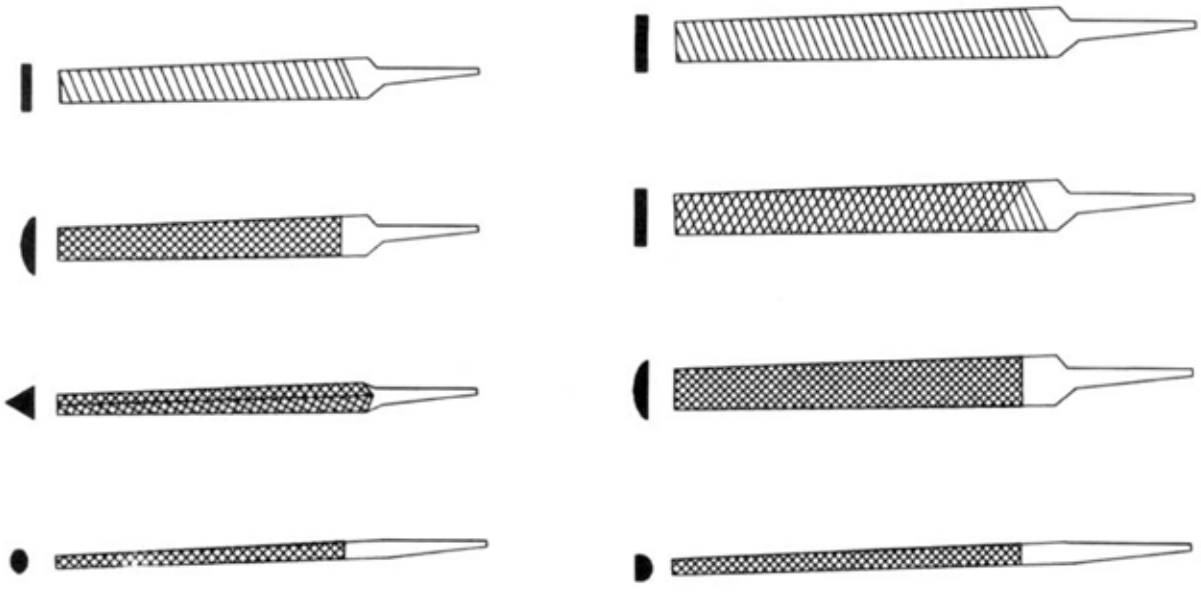


***Figure 16**: Files types showing both the end (shape) and side view.*

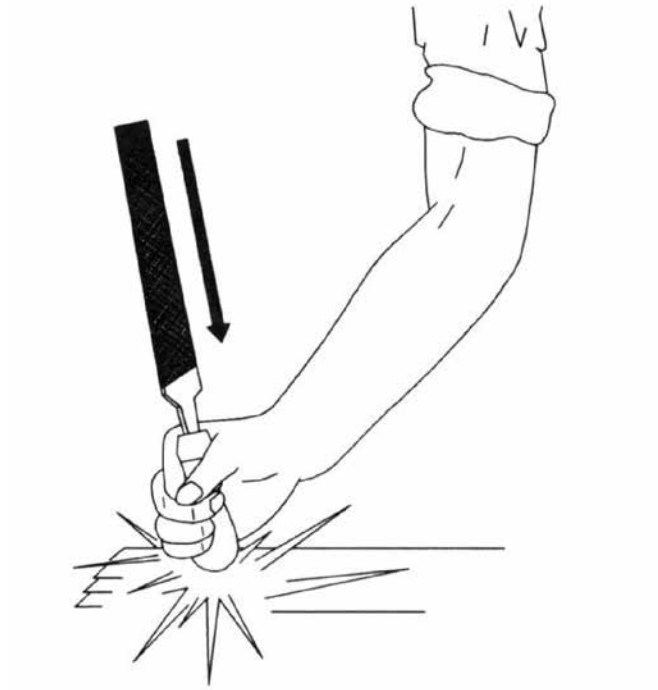


***Figure 17**: Tap the butt end of a file handle on the bench to tighten the file tang in the handle.*

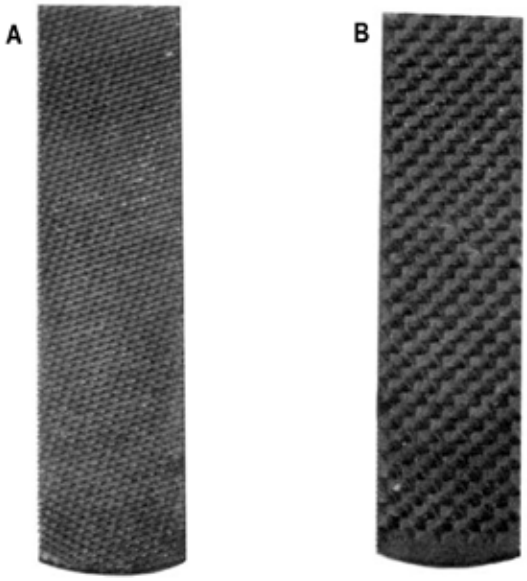


***Figure 18**: Notice the difference between the teeth of (A) file and (B) a rasp.*

The procedure for using a file varies greatly with the type of job and the material. The forward, or cutting, strokes should be smooth and firm with the proper amount of pressure. Insufficient pressure will allow the file teeth to slip over the work without cutting it.

Excessive pressure tends to overload the file teeth so that the cut is irregular. Use only enough pressure to keep the file cutting. On the back, or return, stroke you should lift the file clear of the work. Dragging the file back wears the cutting edge of the file teeth. However, if you are using the file on soft metal, such as lead or brass, you can drag the file on the return stroke. This tends to clean the teeth. In the process known as draw filing, a finishing operation, pull the file across the work crosswise and do not lift the file on the return stroke.

If the file is not cutting, use a file card to clean the file teeth. The file card is a wire bristled brush. Tapping the handle on the bench after every few strokes will also help to keep the file clean, but a file card is also necessary.

When a file is not in use, put it away carefully. Throwing it in a drawer with other tools will chip or dull the teeth. Protect the teeth by putting the file in a file rack, or by wrapping it. Files will rust, so protect them from moisture.

RASPS

Rasps are very coarse files generally used for filing wood. The main difference between a file and a rasp is the teeth. File teeth are made by lines cut in the face. The teeth of a rasp are actually cutting edges on the face. Figure 18 shows the teeth of a file and a rasp.

CAUTION: *Never attempt to use a file as a pry bar, and never hammer on it. Because they are made of very hard metal, files are brittle and will break easily. If you hit one with a hammer, it is likely to shatter into slivers in a dangerous manner.*

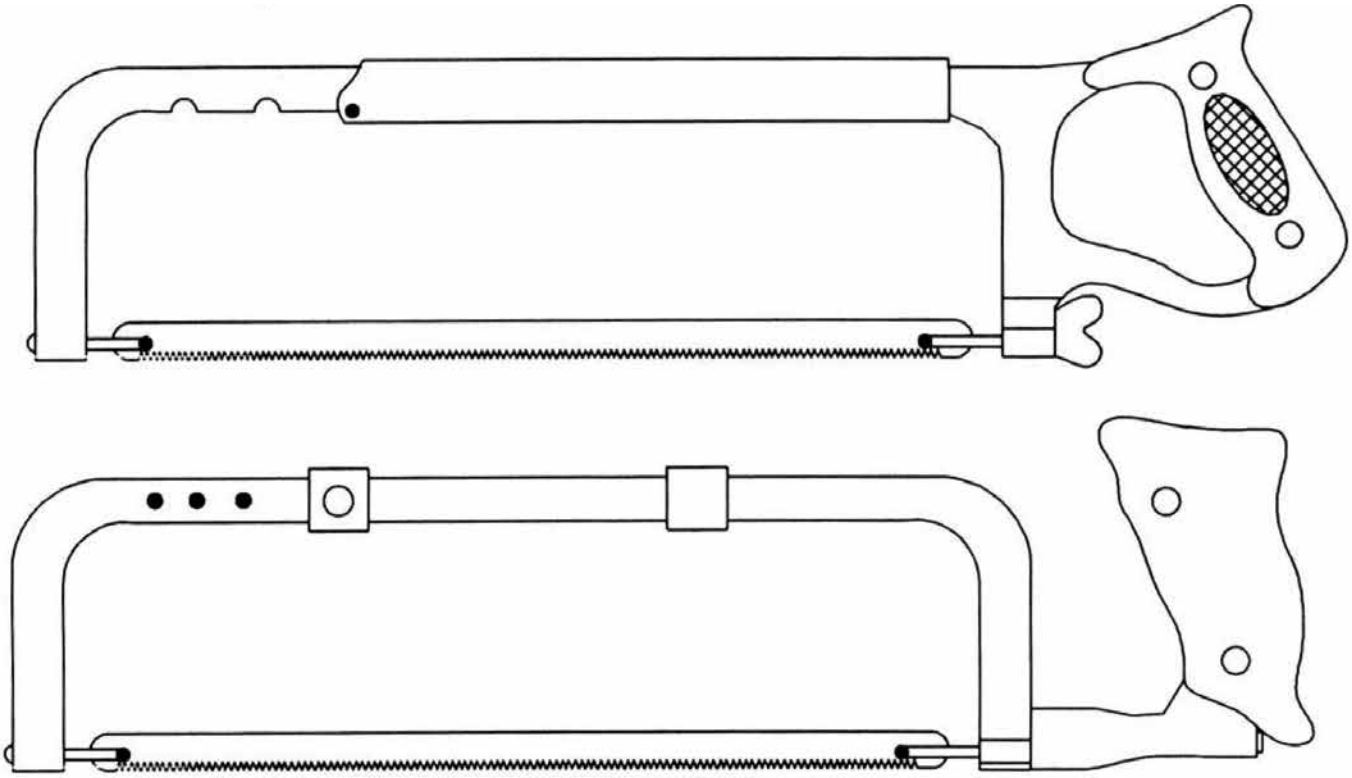


***Figure 19**: Two types of common hacksaws.*

HACKSAWS

The hacksaw, shown in Figure 19, is a special type of saw used to cut metal. The blades are replaceable, and the frame is adjustable for various blade lengths. It is very important to select the correct type of blade for the work you're doing. Blades are made with 14-32 teeth per inch. Using the wrong number of teeth not only makes the job more difficult, but also damages the blade or causes it to break. Figure 20 shows the correct and incorrect blades for various jobs.

After you select the correct blade for the job, place it in the hacksaw frame, as shown in Figure 21. Insufficient tension causes the blade to bend and break. Point the teeth away from the handle so that they cut when you push the hacksaw as shown in Figure 22 on next page.

In use, hold the hacksaw as shown in Figure 23. On the forward or cutting stroke, push the hacksaw evenly with uniform pressure. On the return stroke, lift the blade slightly from the work to avoid wear on the back of the teeth. Twisting or bending the blade when cutting might break it.

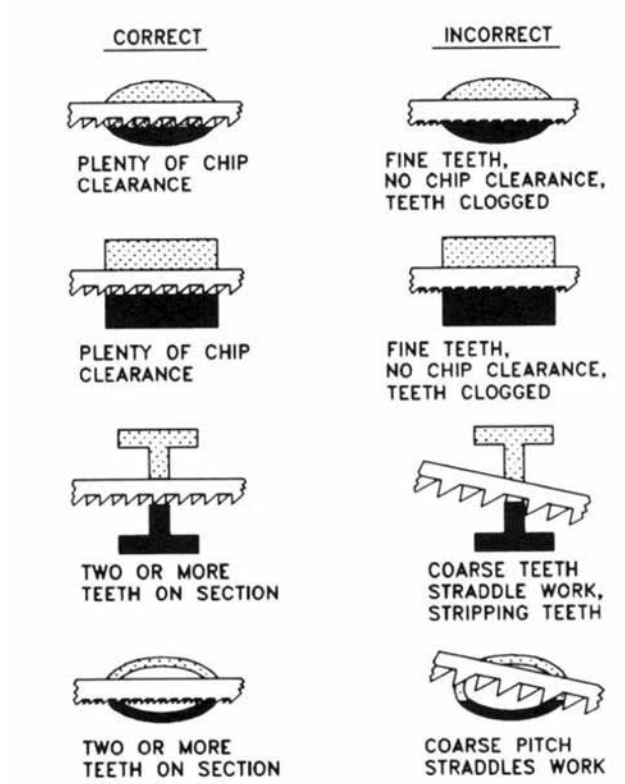


***Figure 20**: The correct and incorrect hacksaw teeth for various jobs.*

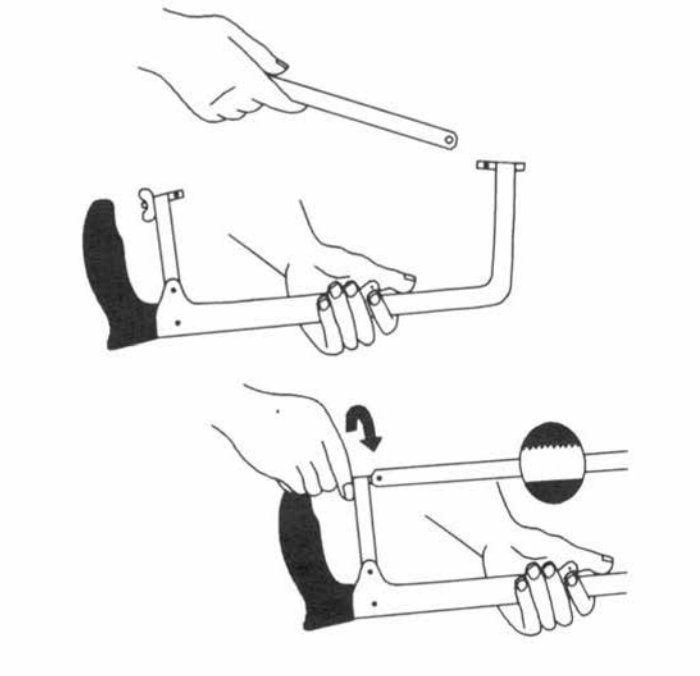


***Figure 21**: Proper insertion and tightening of a hacksaw blade is very important for safety reasons.*

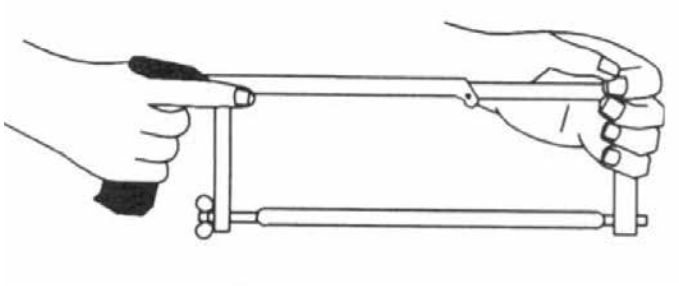


***Figure 23**: Proper way to hold a hacksaw blade while sawing.*

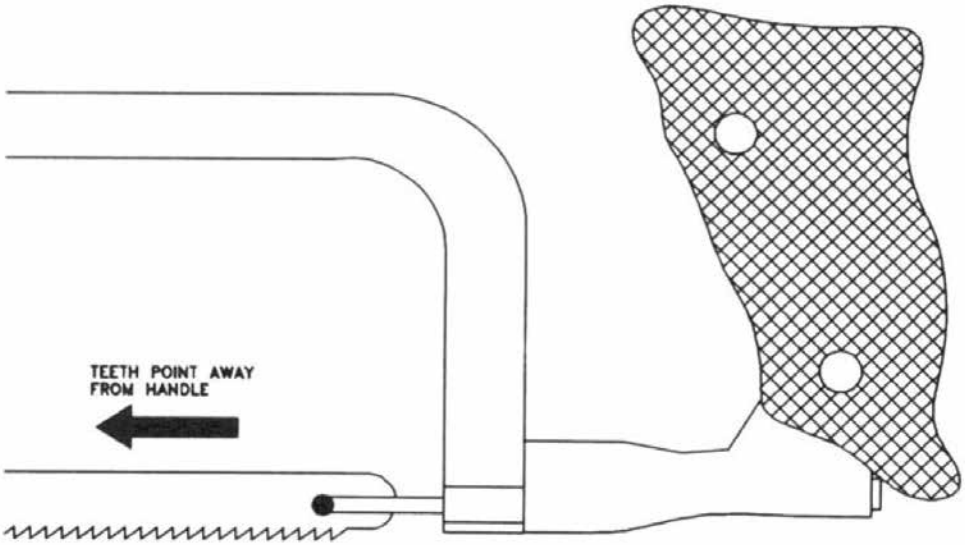


***Figure 22**: It is important that the teeth and hacksaw handle be in the correct relationship.*

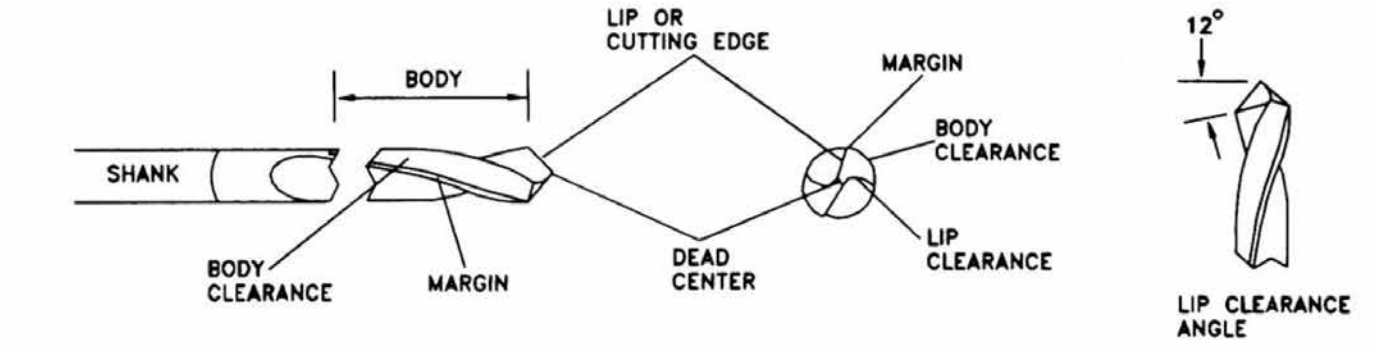


Figure 24: Parts of a twist drill.

DRILLS

Drills are used for making holes. The type of bit used is determined by the material to be drilled. The drill bit, or twist drill, shown in Figure 24, is a cylindrical bar with grooves and a point. The point is shaped to provide a cutting edge. The grooves provide passage through which the chips that have been cut can pass away from the working surface. The shape of the point varies with the material. A gunsmith generally uses a straight-shank drill. This type of drill can be used for both metal and wood.

For most shop work, electrically operated drills are used. These may be portable, like the one shown in Figure 25 on the next page, or permanently assembled into a bench or floor-mounted press, like the one shown in Figure 26 on the next page. Take good care of your electric drills and use them correctly. Keep them cleaned and oiled according to the manufacturer's recommendations. Always turn off the drill before attempting to oil it. This is one of the fundamental safety practices in any shop: always turn off any machine before attempting to oil it.

Never load a drill so much that it stalls. This is very damaging to the motor. Do not click the switch off and on in an attempt to start a stalled drill. This is likely to burn out the switch or the motor. Relieve the load on the motor instead. Also, lighten the feed pressure as the bit breaks through the finished work. This will prevent stalling as the bit cuts through.

Never drag a portable drill around by the cord, and do not leave it lying on the floor where the power cord or the drill bit can get stepped on or otherwise damaged.



Figure 25: Hand-held type of electric drill.



Figure 26: A drill press is an electric drill permanently mounted on a stand.

Wrenches

Types of wrenches include open-end, box, combination (open on one end, boxed on the other) socket, torque, Allen, and adjustable. Open, box, and combination wrenches also have varying degrees of offset.

Although a gunsmith will rarely need wrenches to perform a repair on a firearm, you should be familiar with them. Many of the machines that you will use as your business expands will require adjustment. Also, many pieces of equipment that you may use will require a wrench to change the various attachments.

OPEN-END WRENCHES

Open-end wrenches, shown in Figure 27, are designed to tighten and loosen nuts and bolts. The opening at the end of the body is usually at an angle to its body to permit turning the nut or bolt in a restricted area. After the nut or bolt is turned as far as the space allows, the wrench can be turned over to change the offset angle to allow further turning.

By turning the wrench after each swing, as shown in Figure 28 on the next page, you can loosen or tighten the nut or bolt as needed. Pull on the wrench rather than push it. If you must push on the wrench, do so with the palm of your hand, keeping your fingers out of the way so that if the nut or bolt suddenly gives, you will not be hurt.

Make sure that the wrench fits the bolt head snugly. A loose fit puts excessive strain on the wrench, which may spring or break, and can damage the head of the bolt or nut.

BOX WRENCHES

Box wrenches serve the same purpose as open-end wrenches. However, the opening into which the nut or bolt head fits completely surrounds the head. Box wrenches can be used in restricted spaces because of the thinness of the metal in the wrench head, as shown on Figure 29. The correct size wrench cannot slip off the nut.

Most box wrenches have the head offset at an angle of 15° to the handle, as shown in Figure 30. Other box wrenches have a greater offset angle.

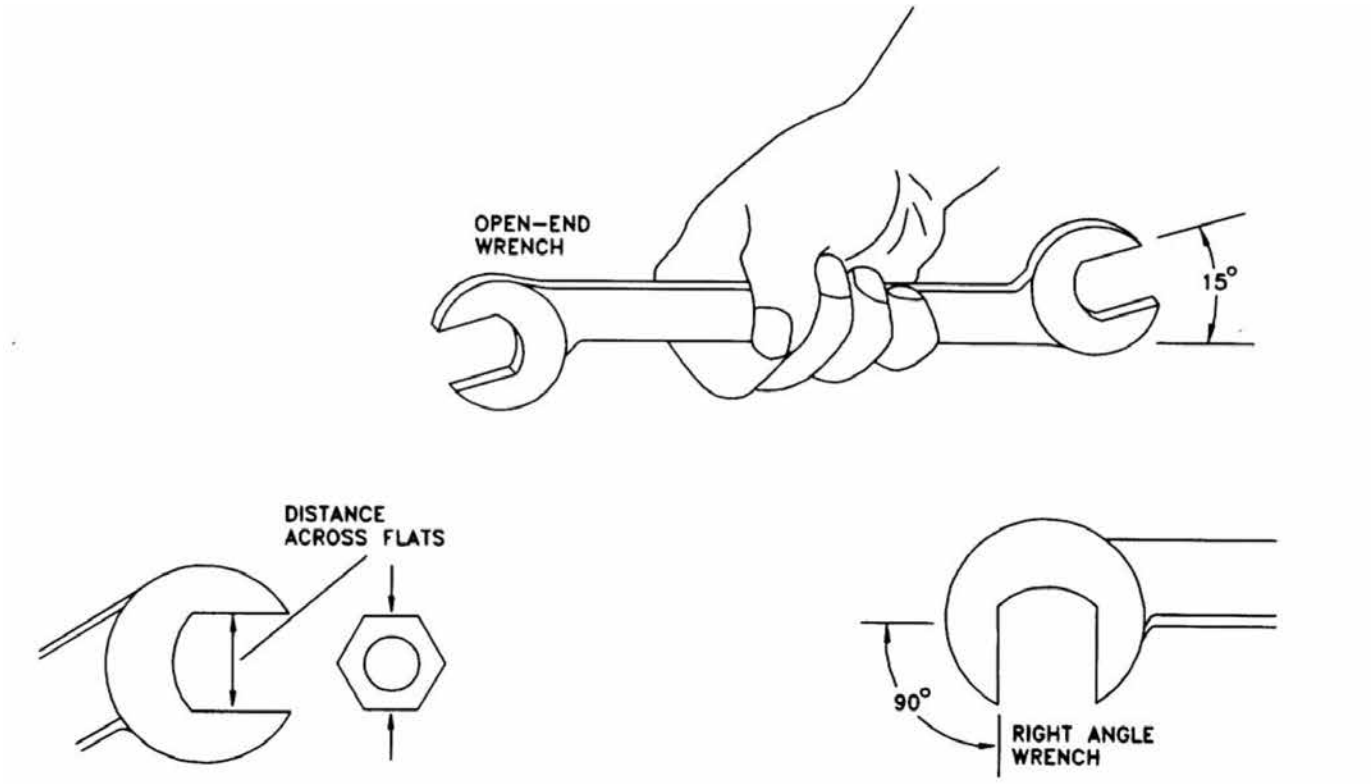


Figure 27: Open-end wrenches.

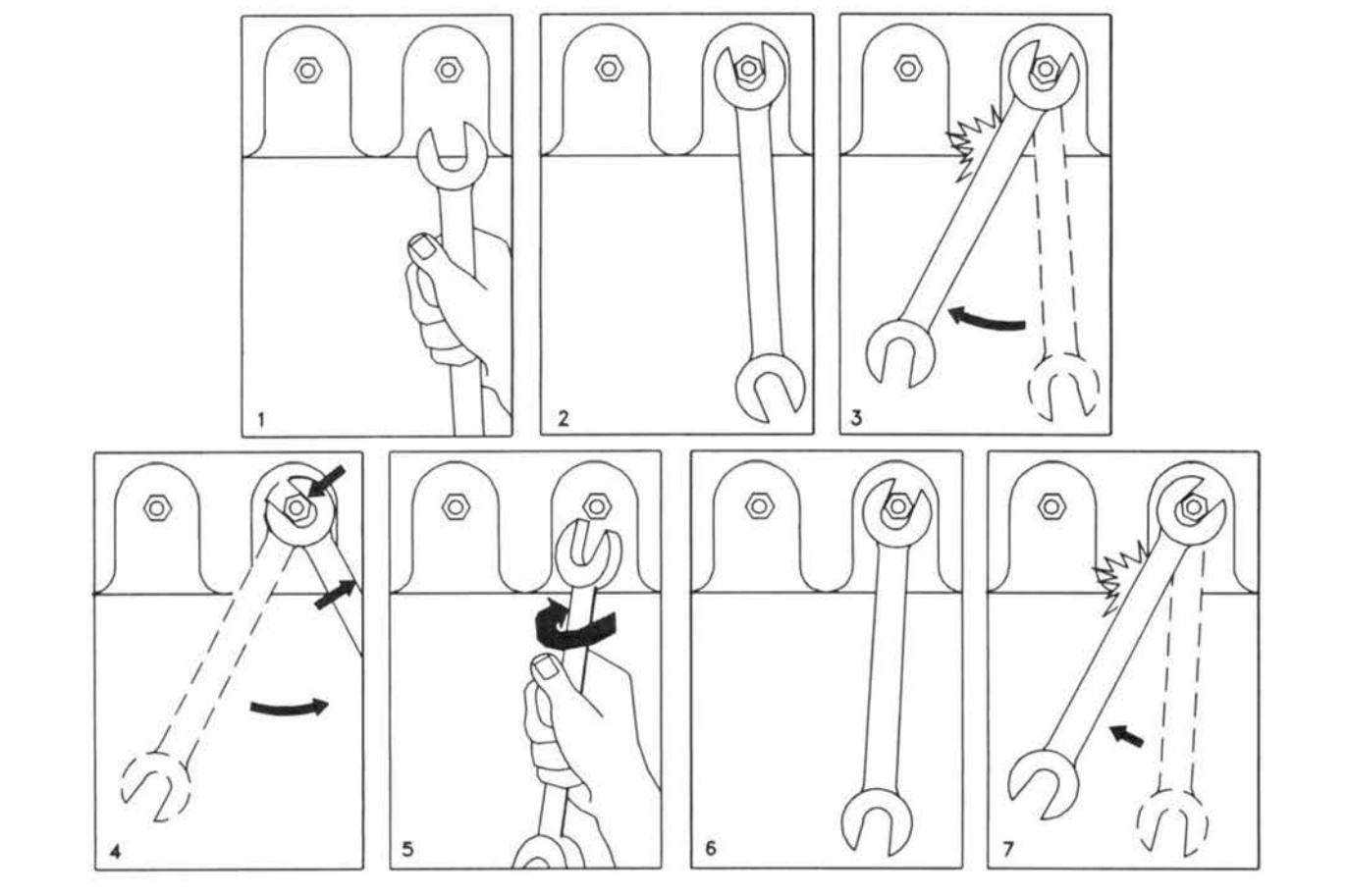


Figure 28: *Using a wrench to turn a nut in a tight space.*

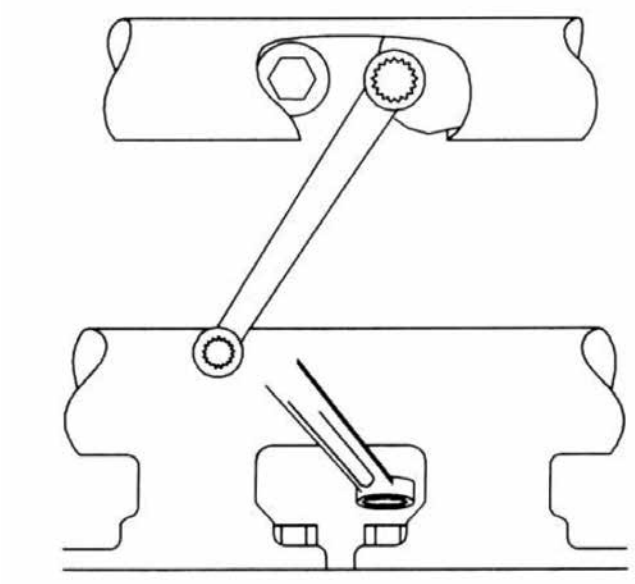


Figure 29: *Using a box wrench in a tight space.*

COMBINATION WRENCHES

These wrenches have a box wrench on one end and an open-end wrench on the other, as shown in Figure 31 on the next page. The functions of the two ends complement each other. The box wrench is best suited for final tightening or for breaking loose a nut or bolt, and less suited for turning since it has to be lifted completely and placed back on for each swing. The open- end wrench is more suited for running a nut or bolt on or off, and less suited for final tightening or breaking loose, since it is more likely to slip off. Both ends of the wrench are the same size.

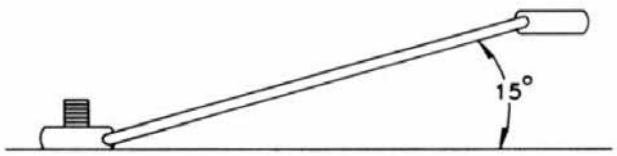


Figure 30: *A 15° box wrench.*

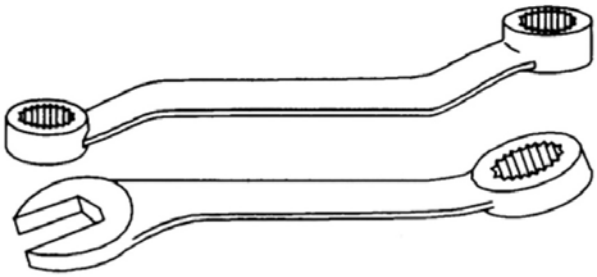


Figure 31: Box and combination wrenches.

ALLEN WRENCHES

These wrenches are used for *Allen*, or set screws, as shown in Figure 32. The Allen screw is widely used on firearms, especially for scope rings.

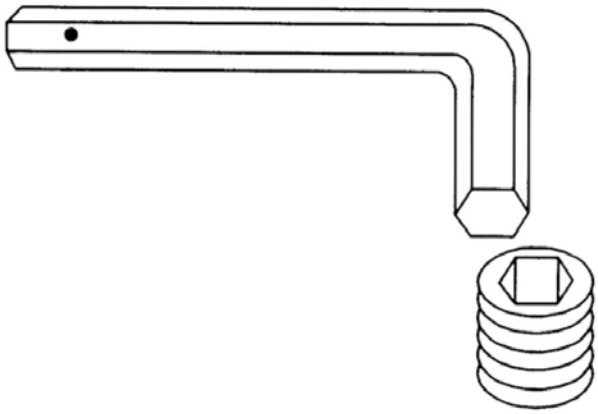


Figure 32: Allen screw and wrench.

Fasteners

Although there are many types of fasteners such as nuts, bolts, and lock washers, a gunsmith will usually only be concerned with screws. Firearms use two basic types of screws: machine and wood. A machine screw is a screw that fits into a threaded hole in a metal part. A wood screw, as its name implies, is driven into a hole in the wood stock.

Figure 33 shows several different types of screws along with how screw length is measured. Notice the wood screw and the sheet metal screw in the figure are both pointed and have the same basic thread design. The difference between them is in the shaft of the screw. The sheet metal screw has a shaft that is parallel from the head to the point. The wood screw is tapered from the head to the point. Always use wood screws, not sheet metal screws, in the stocks of firearms.

When selecting the correct drill bit for the screw, the bit size is based on the diameter of the shaft, not the thread. With wood screws, use the thickest part of the threaded shaft, not the area directly below the head.

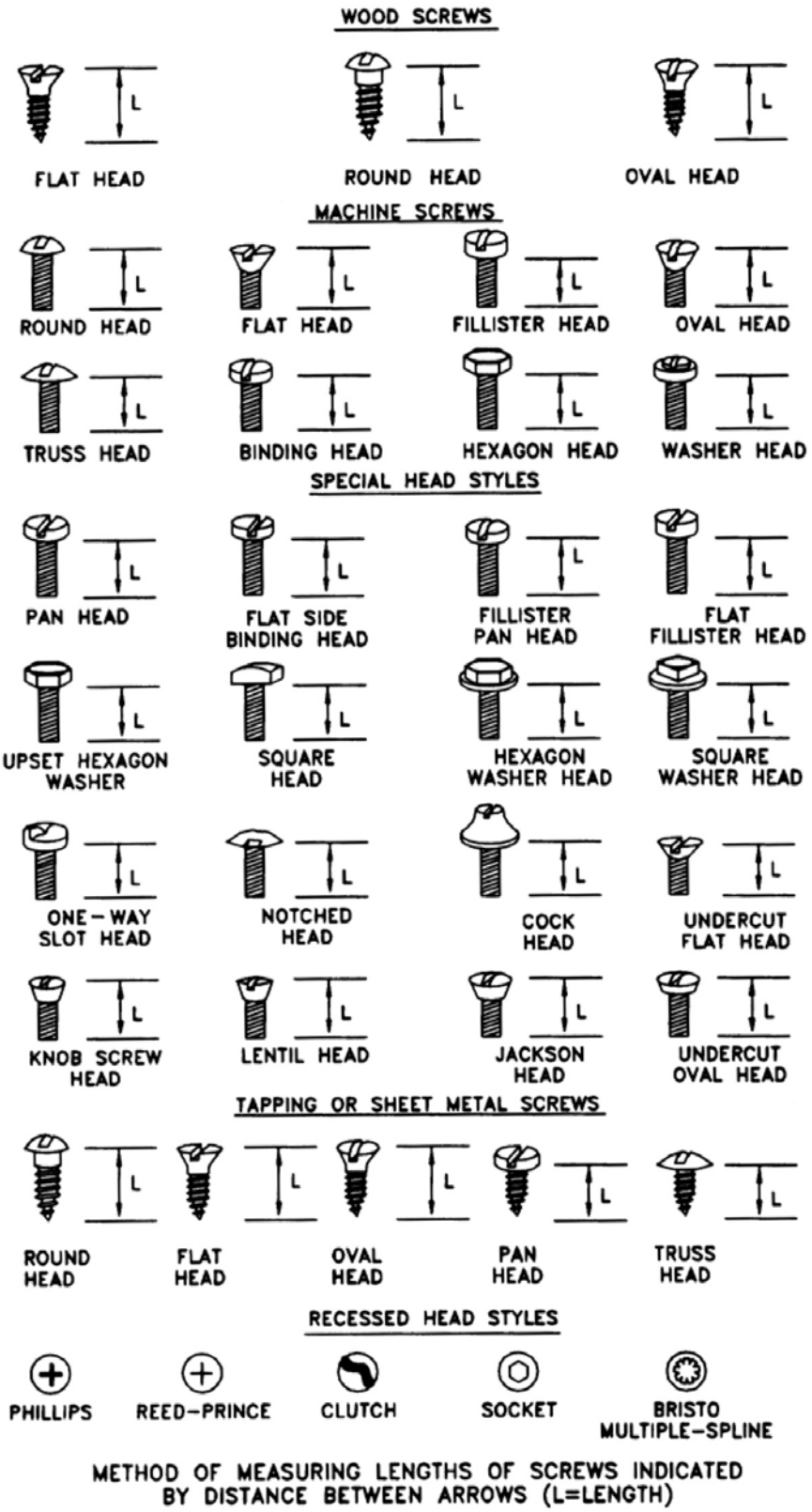
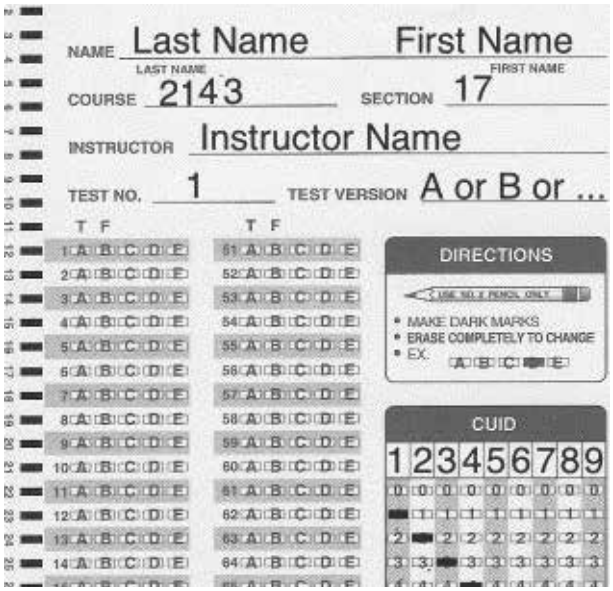


Figure 33: Types of screwheads.

Examination Questions

THIS IS EXAMINATION NUMBER 2490.

Make sure you print your name, student number, and examination number in the space provided on the Answer Form. Be sure to fill in the circles beneath your student number and examination number.



REMINDER: A properly completed Answer Form allows us to evaluate your answers and speed the results and additional study material to you as soon as possible. Do not hold your Answer Forms to send several at one time. You may run out of study material if you do not send your answers for evaluation promptly.

You may also complete your exam online at www.sdi.edu, click on the *online exams* tab.

1. **What type of punch should be used in marking hole locations for drilling?**
   a. Pin punch.
   b. Starter, or drift, punch.
   c. Center punch.
   d. Rivet punch.

2. **Files are made of hardened steel and will not break easily.**
   a. True.
   b. False.

3. **A hacksaw is a special saw designed to cut**
   a. Hard wood.
   b. Plastic.
   c. Rubber.
   d. Metal.

4. **What type of hammer should be used to strike a center punch?**
   a. Ball-peen hammer.
   b. Rubber mallet.
   c. Brass hammer.
   d. Plastic hammer.

5. **What type of screwdriver is used for gunsmithing operations?**
   a. Straight blade.
   b. Clutch.
   c. Hollow-ground.
   d. Torx.

6. **A rat-tail file is:**
   a. Flat.
   b. Round.
   c. Half-round.
   d. Triangular.

7. **The major difference between a file and a rasp is:**
   a. The teeth.
   b. The shape.
   c. The size.
   d. There is no difference.

8. **When selecting a hacksaw blade, always use the one with the most teeth.**
   a. True.
   b. False.

9. **With the blade correctly installed, the hacksaw will cut on the forward stroke.**
   a. True.
   b. False.

10. The type of screw that is used to connect a metal object to a threaded hole in another object is a

a. Sheet-metal screw.

b. Wood screw.

c. Machine screw.

d. Set screw.